ACS Case Reviews in Surgery
Vol. 2, No. 1

A Case of Complicated *Clostridium difficile* Infection (CDI) Treated with Diverting Loop Ileostomy, Colonic Lavage, and Adjuvant Fecal Transplantation

AUTHORS:
Robert T. Nevitt III, MD; and John B. Fobia, MD, FACS

CORRESPONDENCE AUTHOR:
Dr. Robert T. Nevitt III
Mercy Catholic Medical Center
Department of Surgery
1500 Lansdowne Ave, MS82
Darby, PA 19023
(610) 237 – 4960
nevitt.robert@gmail.com

AUTHOR AFFILIATIONS:
Mercy Catholic Medical Center
Department of Surgery
Darby, PA

Background	A 52-year-old female with sigmoid diverticulitis developed superimposed *Clostridium difficile (C. difficile*) infectious colitis, and she progressed to fulminant *C. difficile* colitis requiring emergent surgical intervention.
Summary	A 52-year-old female was admitted for sigmoid diverticulitis and initially responded well to parenteral broad-spectrum antibiotics and bowel rest. Clinical deterioration prompted further workup revealing superimposed *C. difficile* infectious colitis. The patient continued to decline clinically despite aggressive medical therapy, leading to failure of nonoperative treatment. The patient was treated with a combination of a diverting loop ileostomy with intraoperative colonic lavage of high-volume polyethylene glycol followed by postoperative antegrade instillation of vancomycin flushes via the ileostomy, in addition to postoperative fecal microbiota transplantation.
Conclusion	This is a single case of sigmoid diverticulitis with superimposed development of *C. difficile* colitis and progression to a fulminant *C. difficile* infection requiring emergent surgical intervention. In this case, a diverting loop ileostomy with colonic lavage was complimented with postoperative fecal transplantation via the diverting loop ileostomy. As the incidence of *C. difficile* colitis increases and strains evolve, providing combination treatment modalities to combat hypervirulence may be considered to preserve the colon in select patients.
Keywords	*Clostridium difficile*, complicated *Clostridium difficile*, diverting loop ileostomy, colonic lavage

DISCLOSURE:
The authors have no conflicts of interest to disclose.

ABBREVIATIONS:
Clostridium difficile (C. difficile)
Computed tomography (CT)
Nil per os (NPO)
Intravenous (IV)
Infectious Disease (ID)
Intensive care unit (ICU)
Clostridium difficile infection (CDI)
Fecal microbiota transplantation (FMT)

To Cite: Nevitt RT III, Fobia JB. A Case of Complicated *Clostridium difficile* Infection (CDI) Treated with Diverting Loop Ileostomy, Colonic Lavage, and Adjuvant Fecal Transplantation. *ACS Case Reviews in Surgery.* 2018;2(1):30-34.

Case Report

Clostridium difficile (C. difficile), is a gram-positive, anaerobic, spore-forming bacterium identified as the cause of antibiotic associated diarrhea and pseudomembranous colitis in the late 1970s.[1–2] In the past decade, it has become one of the major causes of nosocomial diarrhea and displays a full spectrum of symptoms ranging from asymptomatic to fulminant colitis with systemic toxicity and death.[1-4] The incidence of development of fulminant colitis has been reported to be as high as three percent, with toxic megacolon being a common clinical manifestation of systemic disease.[2,3,5,6] It is anticipated that these numbers will continue to rise paralleling the increasing usage of antibiotics with in-hospital mortality rates for fulminant colitis ranging from 34 percent up to 50 percent.[2,5,6] We present a case of sigmoid diverticulitis with superimposed fulminant *C. difficile* colitis requiring emergent diverting loop ileostomy, intraoperative colonic lavage with high-volume polyethylene glycol followed by postoperative antegrade instillation of vancomycin flushes via ileostomy. This was complemented by fecal transplantation via loop ileostomy resulting in full resolution of infection and subsequent discharge from the hospital.

A 52-year-old African American female presented to the emergency department with a one-day history of abdominal pain that began in her epigastrium and migrated to the left lower quadrant associated with nausea, vomiting, and anorexia. The patient's past medical history is significant for hypertension, hyperlipidemia, diabetes mellitus, coronary artery disease, and diverticulosis, with one previous episode of diverticulitis. On presentation, her vital signs were within normal limits, she had leukocytosis (20.3 k/uL), and she had a non-distended abdomen that was diffusely tender without rebound or guarding. A computed tomography (CT) scan of the abdomen and pelvis was obtained while in the emergency department; this scan demonstrated innumerable descending diverticula with increased stranding and thickening in the sigmoid colon, suggesting diverticulitis.

Given the patient's symptoms and radiologic findings, the patient was admitted to the hospital and made nil per os (NPO). She was started on intravenous (IV) fluid hydration and IV ciprofloxacin and metronidazole. The patient initially responded well to conservative treatment; however, due to worsening pain and a rise in white blood cell (WBC) count (29.3 k/uL), surgical consultation was obtained on hospital day four. On hospital day four, repeat CT of the abdomen and pelvis demonstrated interval worsening of severe diverticulitis involving the descending and sigmoid colon with bowel wall thickening and inflammatory stranding (Figure 1 and Figure 2).

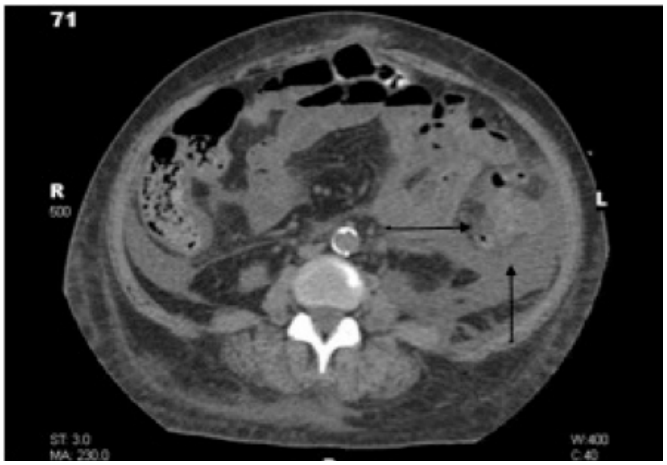

Figure 1. Axial image of worsening diverticulitis involving the descending colon.

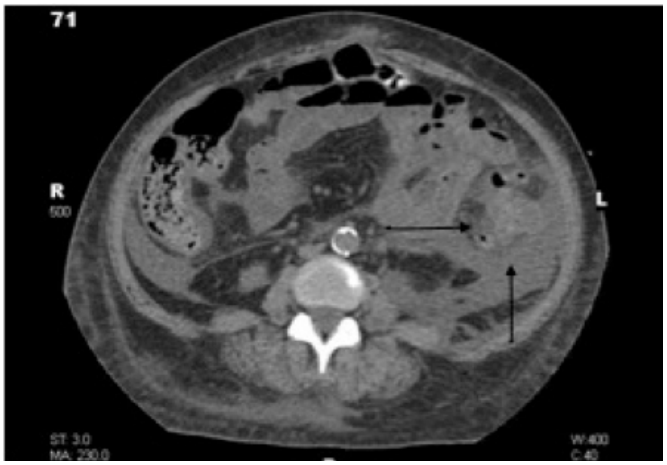

Figure 2. Coronal image of worsening diverticulitis involving the descending and sigmoid colon.

No drainable fluid collections were noted. There was also new thickening of the distal transverse colon, cecum, and ascending colon, interpreted by radiology as superimposed colitis versus new diverticulitis. These new findings prompted *C. difficile* stool studies to be obtained. Infectious disease (ID) consultation was obtained and recommended IV antibiotic coverage changed to ampicillin/sulbactam for better entercoccal coverage. Over the next few days, the patient improved clinically, her WBC counts trended down (13.3 k/uL), and repeat CT abdomen and pelvis on hospital day five demonstrated overall no change, with diffuse wall thickening of ascending, transverse, descending, and sigmoid colon. Per ID recommendations, antibiotics were adjusted to oral amoxicillin/clavulanate.

Subsequently, the patient began having diarrhea, febrile episodes, and *C. difficile* PCR stool studies returned positive. The patient was started on oral metronidazole, but continued her febrile episodes and rising WBCs (33.6 k/uL). Oral vancomycin was added to the patients' antibiotic regimen. The patient was transferred to the intensive care unit (ICU) for close monitoring. The patient continued to develop fulminant *C. difficile* infection (CDI) colitis as she remained febrile, with elevated white cell count (37.6 k/uL), and lactate (8.7 mmol/L). The decision was made to take the patient to the operating room emergently. The patient underwent a diagnostic laparoscopy that was converted to exploratory laparotomy, lysis of adhesions, and diverting loop ileostomy with intraoperative colonic lavage with high-volume polyethylene glycol. Intraoperatively, the entire colon was inspected without evidence of ischemia or necrosis. A total of 8 liters of polyethylene glycol 3350/balanced electrolyte solution was instilled intraoperatively via the efferent ileum through a 24 French Malecot catheter. A rectal tube placed preoperatively was inspected during the installation; it was noted that the brown formed stool became clear. The patient return to the ICU intubated in critical condition. Postoperatively, antegrade instillation of vancomycin 500 mg in 500 mL via the ileostomy every six hours for a total of ten days was performed. ID recommended continued IV metronidazole in conjunction with the vancomycin flushes. Fidaxomicin was added to the vancomycin lavages. On postoperative day two, gastroenterology performed a fecal transplantation from a standard donor acquired from an outside institution using five vials each containing 60 mL through the patient's efferent loop of the ileostomy via the Malecot catheter. The patient subsequently developed acute respiratory distress syndrome needing high oxygenation requirements. The patient eventually underwent low tidal volume protocol with prone positioning. Vancomycin lavages were completed, and the patient clinically improved. The patient underwent tracheostomy with weaning and discontinuation of mechanical ventilation. The remaining hospital course was uneventful, and the patient was discharged to a skilled nursing facility for rehabilitation on hospital day 30. The patient returned for reversal of her diverting loop ileostomy, which was preformed seven months later.

Discussion

In the past decade, CDI has become one of the major causes of nosocomial diarrhea, and this condition displays a full spectrum of symptoms that range from asymptomatic to fulminant colitis with systemic toxicity and death.[2–5] There are several risk factors for the development of CDI, including advanced age, immunodeficiency, health care employment, recent hospitalization, recent gastrointestinal surgery, and, in particular, antimicrobial exposure.[3,4,7] In 1978, antibiotic use was established as the strongest risk factor, with up to 98 percent of patients having had at least one dose of antibiotics in the preceding two weeks.[1,3,4]

CDI was previously considered a hospital-acquired infection; however, recent data suggest that community-acquired infections now account for up to 41 percent of cases.[1-3] There continues to be a considerable increase in the incidence and severity of CDI colitis. United States national database reporting demonstrated a 2 to 2.5-fold increase from the 1990s to the early 2000s.[2,4,5] Oral antibiotic therapy is successful in treating a majority CDI, but 3 to 10 percent of CDI cases will progress to severe, complicated, or fulminant systemic toxicity.[5,7,8]

Most medical guidelines recommend surgical intervention to treat complicated and fulminant CDI.[8] Clinical indications such as worsening abdominal exams, peritonitis, and systemic shock indicate surgical intervention.[5,7,8] When nonoperative management has failed in critically ill patients, total abdominal colectomy with end ileostomy has been advocated as the operation of choice.[5,8–10] The benefits of this approach include minimizing the duration of surgery in critically ill patients, better handling of the enlarged and edematous colon, and decreasing the chance of abdominal compartment syndrome, which can be precipitated by laparoscopic insufflation.[9] Decreased survival has been reported in patients treated with segmental colectomy likely attributed to CDI affecting the entire colon. [10] However, the associated mortality of total abdominal colectomy remains high, with only marginal improved survival compared to nonoperative management.[2,5,7–9,11] The mortality for total abdominal colectomy for CDI ranges from 35 to 80 percent.[2,5,11-14] Subtotal and total colectomy additionally has significant morbidity for survivors, including permanent ileostomy.[2,5,15]

As CDI incidence continues to increase, the surgical treatment for moderate to severe CDI remains debated.[2,15–18] Given the pathophysiology of *C. difficile's* endotoxin-mediated mucosal toxicity and inflammation, the emergence of the diverting loop ileostomy with intraoperative colonic lavage of high-volume polyethylene glycol, followed by postoperative antegrade instillation of vancomycin flushes via the ileostomy, proposes a less morbid approach to treating this disease.[8,15] This technique, described in a case-con-

trol series by Neal et al from the University of Pittsburgh, is promising, but limited by the small cohort, retrospective comparison, and lack of randomization.[9,15] However, this minimally invasive technique is a less morbid procedure with a long-term benefit of colonic preservation, representing a future treatment option early in the disease course.[9,14]

Recently, fecal microbiota transplantation (FMT) has been described as a novel, highly effective intervention in patients with recurrent or refractory *C. difficile* infection.[19–22] FMT has been found to treat refractory CDI with an 81 percent resolution rate.[18] The literature is scarce in regards to treatment of fulminant CDI with fecal transplantation.

Our patient was treated with diverting loop ileostomy with intraoperative colonic lavage of high-volume polyethylene glycol, followed by postoperative vancomycin flushes via the ileostomy, and in addition to postoperative FMT.

Conclusion

We report a single case of sigmoid diverticulitis with superimposed development of CDI colitis, and progression to fulminant CDI, requiring emergent surgical intervention. CT demonstrating diffuse persistent pancolitis, increasing WBCs, and positive *C. difficile* stool toxin, was initially treated conservatively. Nonoperative treatment was initiated with oral metronidazole and escalated to oral vancomycin without clinical improvement. Traditional surgical interventions result in total abdominal colectomy with end ileostomy, which has been found to have mortality and marginal improved survival. Recent clinical trials validated the development of the diverting loop ileostomy and intraoperative colonic lavage with high-volume polyethylene glycol followed by postoperative antegrade instillation of vancomycin flushes via the ileostomy to preserve the colon. In this case, a diverting loop ileostomy with colonic lavage was complimented with postoperative fecal transplantation via the diverting loop ileostomy. With the increasing incidence of *C. difficile* colitis and newly developing hypervirulent strains, it is imperative to continue developing newer protocols to treat evolving bacterial infections.

Lessons Learned

C. difficile infection is a serious and increasingly problematic health care issue. When surgical intervention is required, perhaps less morbid colon preserving techniques should be performed with a multimodal approach, including postoperative fecal transplantation.

References

1. Bartlett J, Moon N, Chang T, et al. Role of Clostridium difficile in antibiotic associated pseudomembranous colitis. *Gastroenterology* 1978;75:778–782.
2. Dallal RM, Harbrecht BG, Boujoukas AJ, et al. Fulminant Clostridium difficile: an underappreciated and increasing cause of death and complications. *Ann Surg*. 2002;235(3):363–372.
3. Khanna S, Pardi DS. The growing incidence and severity of Clostridium difficile infection in inpatient and outpatient settings. *Expert Rev Gastroenterol Hepatol*. 2010;4(4):409-16.
4. Fekety R, Shah AB. Diagnosis and treatment of Clostridium difficile colitis. *JAMA*. 1993;269(1):71-5.
5. Sailhamer EA, Carson K, Chang Y, et al. Fulminant Clostridium difficile colitis: Patterns of care and predictors of mortality. *Arch Surg*. 2009;144(5):433–9.
6. Berman L, Carling T, Fitzgerald T. Defining Surgical Therapy for Pseudomembranous Colitis with Toxic Megacolon. *J Clin Gastroenterol*. 2008;42(5):476-480.
7. Longo WE, Mazuski JE, Virgo KS, et al. Outcome after colectomy for Clostridium difficile colitis. *Dis Colon Rectum*. 2004;47(10):1620–6.
8. Cohen SH, Gerding DN, Johnson S, et al. Clinical practice guidelines for Clostridium difficile infection in adults: 2010 update by the society for health-care epidemiology of America (SHEA) and the infectious diseases society of America (IDSA). *Infect Control Hosp Epidemiol*. 2010;31(5):431–455.
9. Kaiser, AM, Hogen R, Bordeianou L, Alavi K, Wise PE, Sudan R. Clostridium Difficile Infection from a Surgical Perspective. *J Gastrointest Surg*. 2015;19:1363–1377.
10. Surawicz CM, Brandt LJ, Binion DG, Ananthakrishnan AN, Curry SR, Gilligan PH, McFarland LV, Mellow M, Zuckerbraun BS. *Am J Gastroenterol*. 2013;108:478–498
11. Hall JF, Berger D. Outcome of colectomy for Clostridium difficile colitis: a plea for early surgical management. *Am J Surg*. 2008;196(3):384–8.
12. Dudukgian H, Sie E, Gonzalez-Ruiz C, et al. C. difficile colitis—predictors of fatal outcome. *J Gastrointest Surg*. 2010;14(2):315–322.
13. Byrn JC, Maun DC, Gingold DS, et al. Predictors of mortality after colectomy for fulminant Clostridium difficile colitis. *Arch Surg*. 2008143(2):150–4.
14. Synnott K, Mealy K, Merry C, et al. Timing of surgery for fulminating pseudomembranous colitis. *Br J Surg*. 1998;85(2):229–231.
15. Neal, MD, Alverdy, JC, Hall, DE, Simmons, RL, Zuckerbraun,BS. Diverting Loop Ileostomy and Colonic Lavage: An Alternative to Total Abdominal Colectomy for the Treatment of Severe, Complicated Clostridium difficile Associated Disease. *Ann Surg*. 2011;254(3):423-9.

16. Warny M, Pepin J, Fang A, et al. Toxin production by an emerging strain of Clostridium difficile associated with outbreaks of severe disease in North America and Europe. *Lancet*. 2005;366(9491):1079–1084.
17. Eggertson L. C. difficile strain 20 times more virulent. *CMAJ*. 2005;172(10):1279.
18. Loo VG, Poirier L, Miller MA, et al. A predominantly clonal multi-institutional outbreak of Clostridium difficile-associated diarrhea with high morbidity and mortality. *N Engl J Med*. 2005;353(23):2442–9.
19. Nood EV, Vrieze A, Nieuwdorp M, et al. Duodenal Infusion of Donor Feces for Recurrent Clostridium difficile. *N Engl J Med*. 2013;368(5).
20. Johannes A, Gessert CE, Bakken JS. Recurrent Clostridium difficile colitis: Case series involving 18 patients treated with donor stool administered via a Nasogastric tube. *Clin Infect Dis*. 2003;36:580-5
21. Gough E, Shaikh H, Manges AR. Systematic review of intestinal microbiota transplantation (fecal bacteriotherapy) for recurrent Clostridium difficile infection. *Clin Infect Dis*. 2011;53(10):994-1002.
22. Mattila E, Uusitalo-Seppälä R, Wuorela M, et al. Fecal transplantation, through colonoscopy, is effective therapy for recurrent Clostridium difficile infection. *Gastroenterology*. 2012;142(3): 490-6.