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# Determining the optimal surgical timing of fulminant *Clostridium difficile* colitis by using four objective factors and computed tomography findings: A case report

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## ABSTRACT

**INTRODUCTION AND IMPORTANCE:** *Clostridium difficile* colitis is increasingly seen in everyday clinical situations, and most cases are treated with antibiotics. Fulminant *C. difficile* colitis (FCDC) is rare; however, it is extremely virulent, and understanding its appropriate surgical treatment is critical. The surgical timing is controversial because of the lack of concrete decision-making factors. We report a case of FCDC with a favourable outcome, which was achieved by using four objective factors and computed tomography (CT) findings.

**CASE PRESENTATION:** A patient with head trauma developed pneumonia at 2 days post-admission. He was prescribed with antibiotics. Fever and leucocytosis persisted on hospital day 10. *Clostridium* was detected in the stool on day 12, and metronidazole was administered. His condition did not improve; thus, he was started on vancomycin on day 14. The marked deterioration in the four laboratory parameters (white blood cell, albumin [Alb], creatinine, and body temperature) on day 15 and CT findings contributed to the decision to perform emergency subtotal colectomy and ileostomy. His condition improved dramatically postoperatively.

**CLINICAL DISCUSSION:** Many factors of FCDC are already suggested for surgical intervention in the guidelines; however, they are often seen at the late stage of FCDC. Early detection of FCDC is the key to favourable surgical outcome. Following the trend of these objective factors guides in making appropriate surgical decisions.

**CONCLUSION:** Focusing on the four objective factors and CT findings of FCDC could help surgeons detect FCDC at an early stage and decide the optimal surgical timing.

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## 1. Introduction

Clinicians increasingly encounter cases of *Clostridium difficile* colitis in everyday situations, and most cases are successfully treated with antibiotics. Although rare, few patients will develop fulminant *C. difficile* colitis (FCDC) (3–8%) [1]. FCDC is extremely virulent, and it is critical to understand the necessity for appropriate surgical treatment. The surgical timing of FCDC is controversial because of the high morbidity and mortality rates of surgical interventions and the lack of clear factors to guide surgical decisions.

Many guidelines suggest several factors for determining the need to perform a surgical intervention; however, they are still unclear for surgeons, because there is a grey zone between the medically treatable cases and cases requiring surgery. Objective factors, including specific laboratory data and computed tomography (CT) findings, are needed to decide the surgical timing. We described herein a case of FCDC in a young patient with brain damage, in whom the optimal surgical timing was decided according to these objective factors. This case report is compliant with the SCARE 2020 guidelines [2].

## 2. Presentation of case

A 17-year-old male patient presented to the emergency room with a severe head injury due to a motorbike accident. He was intubated owing to severe brain trauma (Glasgow Coma Scale [GCS] score 3) and bilateral lung contusions. He had no abdominal injuries. He was admitted to a neurosurgical unit and received hypothermia treatment with intravenous glycerin for brain injury

**Abbreviations:** FCDC, Fulminant *Clostridium difficile* colitis; CDI, *Clostridium difficile* infection; CT, computed tomography; WBC, white blood cell; Alb, serum albumin; Cr, serum creatinine.

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**Fig. 1.** Abdominal computed tomography (CT) at 14 days after admission.

Horizontal view of CT scan: Transverse colon was dilated and fully enhanced. Coronal view of CT scan: Colon was oedematous and dilated in all sections. Small amount of ascites was seen at the pelvic area. There were also no signs of ischemia and perforation.

for 3 days. At 2 days post-admission, he developed pneumonia, and intravenous antibiotics were administered (ampicillin/sulbactam 6 g/day). He was extubated on day 6 with a good neurological course but he sustained moderate brain damage (GCS 13). He had prolonged low-grade fever throughout the hospitalisation period.

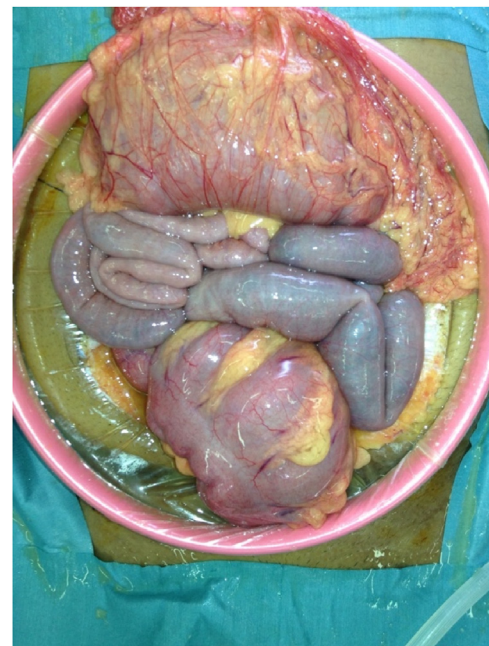
On day 10, he had a fever of 39 °C, and laboratory data showed prominent leucocytosis (30,500 cells/ $\mu$ l) with slight hypoalbuminemia (3.0 mg/dl) but with normal lactate level (0.9 mmol/L) and without renal failure (creatinine [Cr] 0.63 mg/dl). Chest X-ray showed improvement in the clinical signs of pneumonia, and abdominal X-ray showed prominent enteric gases. Clinically, he had normal bowel sounds and had no abdominal pain, abdominal distention, or diarrhoea. On day 12, he still had a fever and passed a small amount of soft stool. Stool examination was performed to determine the cause of fever, revealing the presence of *Clostridium* toxin; thus, his antibiotics were discontinued, and 1500-mg oral metronidazole daily was initiated.

On day 14, his clinical condition did not change, and he had a fever of 37 °C–39 °C. His abdomen was slightly distended, bowel sounds were hyperactive, and he had diarrhoea. Laboratory data showed persistent leucocytosis (41,000 cells/ $\mu$ l), worsening of hypoalbuminemia (2.0 mg/dl), and renal function deterioration (Cr 0.99 mg/dl). Contrast abdominal CT revealed total colonic oedema and slight dilatation, and a small amount of ascites (Fig. 1). He was referred to general surgeons and infectious disease experts, diagnosed with severe *C. difficile* colitis, and started on oral vancomycin (0.5 g/day).

On the next day, his clinical condition was still unchanged. However, laboratory tests showed further worsening of hypoalbuminemia, renal function deterioration (Alb, 1.7 mg/dl; Cr, 1.36 mg/dl), and increased lactate level (3.5 mmol/L), despite medical treatment. The worsening of the leucocytosis and hypoalbuminemia, and renal failure symptoms in 1 day was crucial for deciding to perform emergency subtotal colectomy and ileostomy on day 15.

During surgery, massive clear ascites was collected (1200 mL), which was not detected by the previous CT. There were no ischemic or abnormal findings from the colon's external view, except for the abnormal dilation (megacolon) (Fig. 2). We performed subtotal colectomy and ileostomy with closed intraperitoneal distal stump. The resected colonic specimen had a pseudomembranous covering nearly all the mucosa (Fig. 3).

Postoperatively, he was extubated in the operating room and received intravenous metronidazole (2 g/day) for 8 days and vancomycin enema (2 g/day) for 10 days. His condition improved



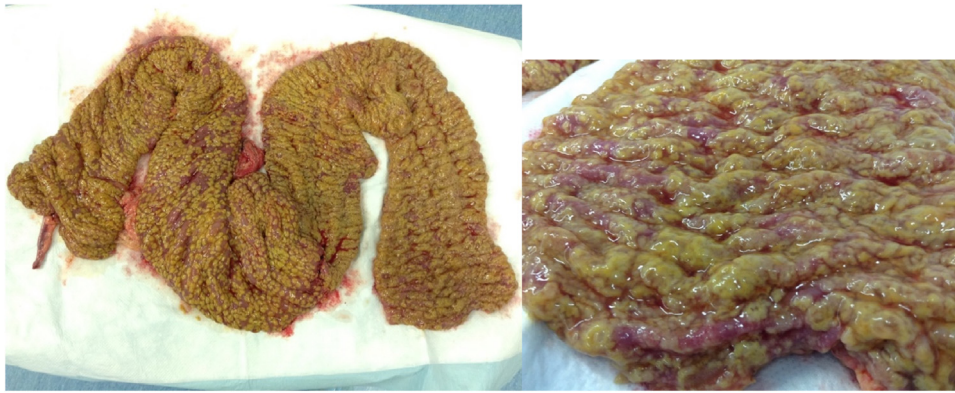
**Fig. 2.** Surgical view of the colon.

During the operation, massive clear yellow ascites was collected and the external appearances of the transverse colon (upper, omentum attached) and sigmoid colon (lower) were fine, except for the presence of massive dilatation.

dramatically, his fever resolved the day after the operation, and he started to take in water and food on postoperative day 3. His renal function has also improved. After the brain trauma treatment, he was transferred to the rehabilitation centre at 58 days post-admission. At 5 months postoperatively, as he had fully recovered and returned to school, he underwent ileostomy closure with ileorectal anastomosis.

### 3. Discussion

FCDC is a rare condition (3–8%), but it is well known to have a high mortality rate (35–80%)[1,3–6]. *C. difficile* infection (CDI) guidelines recommend surgical interventions when critical factors (shock state, multiple organ failure, intubation, intensive care unit admission) are present or when the white blood cell count



**Fig. 3.** The resected colonic specimen. The resected colon, from the terminal ileum to the recto-sigmoidal colon, is shown. There were no perforations or ischemic changes. A pseudo-membrane covered nearly all of the mucosa, and identifying the normal mucosa was difficult. There were no ischemic findings in the mucosal surfaces as well.

**Table 1**  
Published guidelines and definitions for *Clostridium difficile* infection (modified).

Guidelines	Severe CDI	(Complicated CDI)	Fulminant CDI/suggested for surgical intervention
SHEA/IDSA (2017)[8]	WBC $\geq 15,000$ cells/ $\mu$ l	Cr $>1.5$ mg/dl (absolute data) Lactate $>5.0$ mmol/l	Hypotension, shock, ileus, megacolon, WBC $\geq 25,000$ cells/ $\mu$ l
WSES (2019) [18]	WBC $>15,000$ cells/ $\mu$ l Increase in serum Cr level $\geq 133$ $\mu$ m/l or 1.5 times the pre-morbid level BT $> 38.5$ °C	Alb $<2.5$ g/dl Lactate 2.2–4.9 mmol/l, age $\geq 65$ years [3] WBC $>18,000$ cells/ $\mu$ l, hemodynamic instability, age $>70$ years [19] WBC $\geq 20,000$ cells/ $\mu$ l, or 2000 cells/ $\mu$ l $\leq$ , cardiorespiratory failure, diffuse abdominal tenderness, age $>70$ years [20] WBC $\geq 35,000$ cells/ $\mu$ l or 4000 cells/ $\mu$ l $<$ , neutrophil bands $\geq 10\%$ , Cardiopulmonary failure, age $\geq 70$ years [6]	Several suggestions: WBC $\geq 50,000$ cells/ $\mu$ l,  Lactate $>5.0$ mmol/l, age $\geq 75$ years, Immunosuppression, shock <i>Beneficial colectomy</i> : WBC $\geq 20,000$ cells/ $\mu$ l,
ACG (2013) [7]	WBC $\geq 15,000$ cells/ $\mu$ l, Alb $<3.0$ g/dl, abdominal tenderness	WBC $\geq 35,000$ cells/ $\mu$ l or 2000 cells/ $\mu$ l $\leq$ , BT $> 38.5$ °C Lactate $>2.2$ mmol/l  Abdominal distention	WBC $\geq 50,000$ cells/ $\mu$ l, lactate $>5.0$ mmol/l  Hypotension, sepsis, and organ dysfunction, ICU admission No improvement after 5 days despite medical therapy (suggesting early operation before shock and organ failure state)
ESCMID (2014) [9]	WBC $\geq 15,000$ cells/ $\mu$ l, Alb $<3.0$ g/dl,  Cr $\geq 133$ $\mu$ m/l or 1.5 times the pre-morbid level		Perforation of the colon, systemic inflammation, deteriorating clinical condition Surgery before severe colitis state, lactate $>5.0$ mmol/l

CDI, *Clostridium difficile* infection; SHEA/IDSA, the Society for Healthcare Epidemiology of America/the Infectious Diseases Society of America; WSES, The World Society of Emergency Surgery; ACG, the American College of Gastroenterology; ESCMID, the European Society of Clinical Microbiology and Infectious Diseases; WBC, white blood cell (cells/ $\mu$ l); Cr, serum creatinine; BT, body temperature; Alb, serum albumin.

is  $\geq 50,000$  cells/ $\mu$ l and/or the lactate level is  $\geq 5$  mmol/l [7–9]. However, several articles show preferable results for early surgical intervention compared to late surgery or medical treatment [10–12], and there are no scoring systems or guidelines for deciding on the best surgical timing. Thus, practical key factors for surgical intervention could be discussed.

The CDI definitions from four major guidelines are shown in Table 1, and we comprehensively focused on the following four factors from the guidelines: WBC, Alb, Cr, and body temperature. These factors can be evaluated objectively, and they facilitate bedside determination of severe CDI and detect deteriorating and surgical cases [13]. Serum hypoalbuminemia also correlates with the CDI

severity [14]. Di Masi et al. suggest that human serum Alb acts as a 'buffer system' by binding *C. difficile* toxins A and B in the blood vessels; however, in severe CDI, Alb cannot neutralise all *C. difficile* toxins, leading to severe toxemia. In this case, daily monitoring of these four objective data detected the ineffectiveness of medical treatment. The ongoing hypoalbuminemia was prominent in our case and contributed to the prompt decision for performing a surgical intervention.

CT findings are also a factor in deciding surgery. The diagnostic findings of CD colitis include colonic wall thickening, pancolitis, accordion/target sign, and ascites. CT has a high specificity (93%) for CDI diagnosis with the abovementioned findings [15] and a low false-negative rate (0–22%) [16]. CT findings can be used as a tool for detecting FCDC and determining the need for surgical interventions, especially in deciding whether to perform an early operation. The Monterrey CT scale was introduced for detecting FCDC with five parameters [17]. In our case, oedema and bowel dilatation were detected by CT (definite for FCDC with Monterrey score of 11) and were used to decide whether to execute surgery. Combining laboratory data and CT findings with this score can be a good tool for the deciding when to perform a surgical intervention in FCDC patients.

The strength of this study is that the objective factors were closely followed up; thus, FCDC worsening was detected early and the patient underwent surgery at optimal timing. The favourable results of our case were similar to those of previously reported cases receiving early interventions [10–12]. However, the study also had several limitations. Firstly, this was a case report. More studies are needed to establish the surgical timing guidelines. Secondly, subtotal colectomy and ileostomy were performed on our patient because these procedures were standard in the available guidelines. However, there was a high potential for alternative, less invasive procedures, including loop ileostomy with colonic lavage [8,18]. With earlier surgical interventions, patients would likely achieve a more stable state, and such alternative procedures may be a suitable option.

#### 4. Conclusion

We outline the process of deciding on whether to perform a surgical intervention for FCDC based on four objective factors and CT findings. We focused on practical and objective measures that may be used in future clinical cases and studies to create a definitive threshold for the surgical treatment of FCDC.

#### Patient perspective

N/A.

#### Declaration of Competing Interest

The authors report no declarations of interest.

#### Funding

No received funding.

#### Ethical approval

This study is exempted from obtaining an ethical approval from our institution.

#### Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy

of the written consent is available for review by the Editor-in-Chief of this journal on request.

#### Author contribution

Shima Asano, MD, MPH: creating the study concept and writing the paper  
Morihiro Katsura, MD, MPH: reviewing the draft.

#### Registration of research studies

Not Applicable.

#### Guarantor

Shima Asano, MD, MPH.

#### Provenance and peer review

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