

**The Effects of Prior Esophagogastroduodenoscopy on Cecal Insertion in  
Same-Visit Bidirectional Endoscopy: A Pilot Study**

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## The Effects of Prior Esophagogastroduodenoscopy on Cecal Insertion in Same-Visit Bidirectional Endoscopy: A Pilot Study

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### Abstract

**OBJECTIVES:** Same-day bidirectional endoscopy (BDE) has become a commonly used. Several studies have identified that the optimal sequence of a same-day BDE was esophagogastroduodenoscopy (EGD) followed by colonoscopy (CS). However, in recent years there are no reports from Japanese facilities regarding the difficulty of colonoscopy insertion along with a same-day BDE. In this study, we sought to clarify CS difficulties if EGD was performed first followed by CS on the same-day.

**METHODS:** This study was a single-center retrospective study, and included 61 patients who underwent EGD followed by CS (E-C group) and 120 patients who underwent CS only (CS only group). We defined a “difficult CS case” as one that required  $\geq 650$  s for colonoscope insertion.

**RESULTS:** The numbers of difficult CS cases were not significantly different between the E-C and CS only groups ( $p = 0.131$ ). Furthermore, no correlations existed between EGD examination times and colonoscope insertion times (Spearman  $\rho = 0.096$ ). In addition, for patients whose body mass index (BMI) was  $<18.5$  and  $\geq 25$ , the number of difficult CS cases was significantly lower in the E-C group than that in the CS only group ( $p = 0.038$ ).

**CONCLUSIONS:** No significant differences were seen between the number of difficult cases in the E-C and CS only groups. In patients with BMI of  $<18.5$  or  $\geq 25$ , fewer cases of CS difficulty might be encountered if EGD is performed first.

**Key words:** bidirectional endoscopy, colonoscopy insertion, difficult colonoscopy case

## Introduction

Colonoscopy (CS) is widely used to diagnose and treat colorectal diseases. A high rate of cecal intubation is required to achieve a complete and thorough examination of the colon; however, sometimes difficulties arise during colonoscope insertion. Several studies have identified that certain variables pose difficulties during colonoscope insertion<sup>1-6</sup>. In addition, the colon is an easily distensible, mobile elastic tube, which becomes long and tortuous when overinflated, thereby enhancing procedural difficulties. Hence, endoscopists must frequently minimize air insufflation and suction during CS intubation periods<sup>7, 8</sup>. Equally, esophagogastroduodenoscopy (EGD) and CS may be sequentially performed on the same day. In our hospital, we routinely perform EGD first when we perform same-day bidirectional endoscopy (BDE). Several studies reported that the optimal sequence of a same-day BDE was EGD followed by CS<sup>9,10</sup>. Additionally, previous studies reported that there was no difference in the cecal intubation time between patients in EGD followed by CS group and CS followed by EGD group<sup>9,10</sup>. However, there are no reports from Japanese facilities about the difficulty of colonoscopy insertion along with a same-day BDE in recent years. Hence, we sought to clarify the insertion effects of CS if EGD was performed first, followed by CS on the same-day.

## Materials and Methods

**Patients:** This was a single-center retrospective study. In total, 203 patients underwent CS between May and August 2020 at our hospital. The medical records of these 203 consecutive patients were retrospectively reviewed, at which point 22 patients with a history of colonic surgery were excluded. Of the remaining 181 patients, 61 underwent EGD followed by CS (E-C group), whereas 120 patients underwent CS only (CS only group) (Figure 1). The study was approved by the

Institutional Review Board of Kagoshima Prefectural Oshima Hospital (Permission number: 63). This project was a retrospective observational study. We offered an opt-out for participants to provide the opportunity to reject participation in the study.

**Bowel preparation:** Patients underwent bowel preparation using senna and sodium picosulfate on the day before the examination, and polyethylene glycol solution-containing lavage the morning of the procedure. We used the Boston bowel preparation scale (BBPS) for analyses.

**Sedation and antispasmodic drugs:** Midazolam was administered based on the judgment of the examining colonoscopist or when requested by the patient. Scopolamine butylbromide was administered intramuscularly to suppress bowel movement, while patients with cardiac disease or benign prostatic hypertrophy received intramuscular glucagon.

**CS and EGD:** CS and EGD were conducted at dedicated endoscopy suites. We used the following equipment: Olympus Evis-Lucera CV-290 and CV-260SL based unit; Olympus PCF-Q260AI and PCF-Q260AZI model colonoscopes; and Olympus GIF-H290Z, GIF-H260Z, GIF-Q260J, and GIF-Q260 model gastrointestinal endoscopes. CO<sub>2</sub> or air insufflation was used as required during EGD and CS. Additionally, three highly experienced colonoscopist (≥1000 previous colonoscopies) performed the procedures.

Colonoscope insertion times were defined as the time from the first image of the rectal mucosa, to the first image of the cecal mucosa. In addition, EGD examination times were defined as the time from the first image of the esophagus mucosa during insertion, to the last image of the esophagus mucosa during removal. Although previous reports classified a 10 min insertion time as a “difficult CS case”<sup>1,2</sup>, for more accuracy, we defined it as a case that required ≥650 s for insertion. This cutoff value of time was defined as twice the median (326.5 s) from a box plot of insertion times in the CS only group (Figure 2). In E-C group, the median

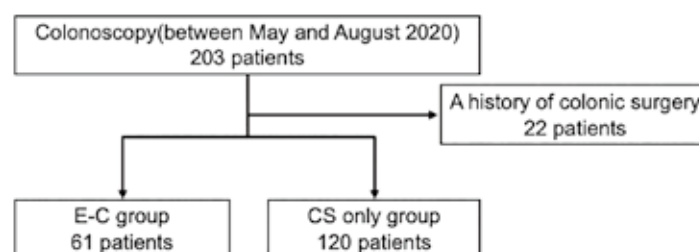
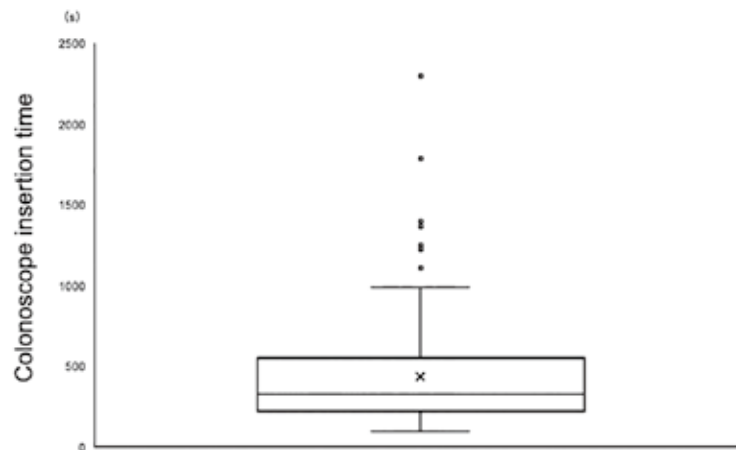


Figure 1 Study flowchart.



**Figure 2 CS insertion times in the CS only group.** The median in box plot of insertion time in the CS only group was 326.5.

from a box plot of insertion times was 288 s.

**Date collection and outcome measures:** Demographic data and clinical characteristics [age, gender, body mass index (BMI), patient type, diverticulosis, melanosis, indication for CS, history of abdominal surgery, CO<sub>2</sub> use, sedation, BBPS, and adenoma detection rate (ADR)] of all patients were collected. Patient backgrounds of the E-C group and the CS only group were compared. ADR was defined for the patients  $\geq 50$  years undergoing screening colonoscopy for the first time and who had one or more conventional adenoma detected and removed<sup>11</sup>. The primary outcome was the number of difficult CS cases. Moreover, the relationship between EGD examination time and colonoscope insertion time (for patients with  $< 650$  s for insertion) was also examined. In addition, based on the results of previous literatures, female, BMI of  $< 18.5$  or  $\geq 25$ , and patients with a history of abdominal surgery were identified as factors associated with difficult CS cases<sup>1-6</sup>. Thus, secondary outcomes were defined as the number of difficult CS cases by these factors.

**Statistical analysis:** Differences between the two groups were assessed using Student's t-test or the Mann-Whitney test and Fisher's exact test. The Student's t-test or the Mann-Whitney test was depended on the result of the Shapiro-Wilk test and Levine's test for normality and equality of variance. A p value  $< 0.05$  indicated statistical significance. The Spearman's rank correlation test was used to assess the relationship between EGD examination time and colonoscope insertion time. All statistical analyses were performed using the Statistical Package for the Social Sciences Statistic (SPSS) software version 25 (IBM Corp., Armonk, NY, USA).

## Results

Baseline demographic characteristics are presented in Table 1. There was no significant difference in the patient age, sex, BMI, patient type, diverticulosis, melanosis coli, indication for CS, history of abdominal surgery, CO<sub>2</sub> use, and sedation. Additionally, bowel cleansing did not show any significant difference. Among the patients aged  $\geq 50$  years undergoing screening colonoscopy for the first time, 23 were in the E-C group and 27 in the CS only group. Furthermore, no significant difference was observed in the ADR between the E-C and CS only groups (Table 1).

**Primary outcomes:** The number of difficult CS cases showed no significant differences between the E-C and CS only groups ( $p = 0.131$ ) (Table 2). Furthermore, no correlations were observed between EGD examination time and colonoscope insertion time (Spearman  $\rho = 0.096$ ) (Fig. 3).

**Secondary outcomes:** In female patients and patients with a history of abdominal surgery, we observed no statistical differences between the groups in terms of the number of difficult CS cases. In patients with BMI of  $< 18.5$  or  $\geq 25$ , the number of difficult CS cases was significantly decreased in the E-C group, when compared with the CS only group ( $p = 0.038$ ) (Table 2).

## Discussion

We observed no significant differences in the number of difficult cases between the E-C and CS only groups (Table 2). This result was consistent with the previous reports<sup>9,10</sup>. Furthermore, there were no correlations

**Table 1. Patient characteristics**

Characteristics	E-C group	CS only group	<i>p</i> value
Age, mean $\pm$ SD (years)	68.8 $\pm$ 12.5 (17–91)	66.6 $\pm$ 12.1 (31–89)	0.152 <sup>a</sup>
Gender, M/F	37/24	75/45	0.467 <sup>b</sup>
BMI (kg/m <sup>2</sup> )	23.6 $\pm$ 4.4	23.8 $\pm$ 3.7	0.764 <sup>c</sup>
Patient type			
Outpatient	53	110	0.827 <sup>b</sup>
Inpatient	8	10	
Emergency	0	0	
Diverticulosis; Yes/No	26/35	53/67	0.485 <sup>b</sup>
Melanosis coli; Yes/No	2/59	2/118	0.414 <sup>b</sup>
Indication for CS			
Screening or surveillance	53	96	0.184 <sup>b</sup>
Diagnosis	5	21	
Inflammatory bowel disease	3	3	
History of abdominal surgery, Yes/No	15/46	33/87	0.620 <sup>b</sup>
CO <sub>2</sub> use; Yes/No	36/25	65/55	0.322 <sup>b</sup>
Sedation; Yes/No	59/2	112/8	0.284 <sup>b</sup>
BBPS, 0/1/2/3	0/3/18/40	0/5/26/89	0.474 <sup>b</sup>
CS Insertion time, median, range (s)	288 (142-760)	326.5 (94-989)	0.233 <sup>a</sup>
ADR, n (%)	7/23 (30.4)	9/27 (33.3)	0.485 <sup>b</sup>

CS, colonoscopy; SD, standard deviation; BBPS, Boston bowel preparation scale; BMI, body mass index; ADR, adenoma detection rate

a. Mann-Whitney test, b. Fisher's exact test, c. Student's *t*-test

**Table 2. Difficult cases**

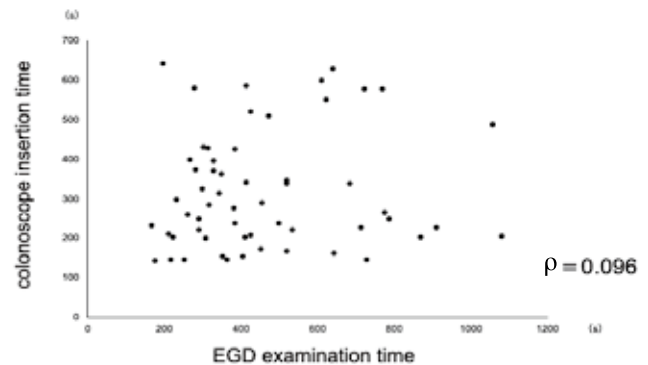
	E-C group	CS only group	<i>p</i> value
Total, n	61	120	
Difficult cases, n (%)	4(6.6)	17(14.2)	0.1 <sup>a</sup>
Female, n	24	45	
Difficult cases, n (%)	1 (4.2)	6 (13.3)	0.223 <sup>a</sup>
BMI < 18.5 or $\geq$ 25, n	25	53	
Difficult cases, n (%)	0 (0)	8 (15.1)	0.038 <sup>a</sup>
History of abdominal surgery (+), n	15	33	
Difficult cases, n (%)	2 (13.3)	4 (12.1)	0.620 <sup>a</sup>

CS, colonoscopy; BMI, body mass index

a. Fisher's exact test

between EGD examination time and colonoscope insertion time (Figure 3). Additionally, we investigated literature-identified factors attributed to difficult CS cases, i.e., female patients, patients with BMI of  $<18.5$  or  $\geq 25$ , and patients with a history of abdominal surgery<sup>1-6</sup>. Of these factors, the proportion of patients with BMI of  $<18.5$  or  $\geq 25$  was the highest at 43.1%. Moreover, for that proportion of patients, the number of difficult CS cases significantly decreased in the E-C group when compared with the CS only group. BMI was reported to be one of the predicting factors of difficult CS cases<sup>2,6</sup>. In cases of lower BMI, these studies explained that lower amount of visceral fat in patients may be the cause of difficult CS cases. It can be inferred that visceral fat allows for an easier passage of the colonoscope by supporting the colon in the pelvis and thereby reducing loop formation<sup>6</sup>. When EGD was performed before CS, presence of gas in the upper gastrointestinal tract may reduce the mobility of the colon and reduce loop formation. In addition, Moon et al. reported that BMI  $\geq 25$  was a predictor of a longer cecal insertion time<sup>2</sup>. Previous reports have indicated that transabdominal pressure was useful for CS procedures<sup>12,13</sup>, but the application of abdominal pressure was difficult on obese patients<sup>14,15</sup>. A recent study in which abdominal compression was obtained with a fitted corset to facilitate CS reported that extra abdominal compression and a change of position was used less frequently in the study facilitating lower procedural pain<sup>16</sup>. The presence of gas in the upper gastrointestinal tract due to EGD may have had the same effect as transabdominal pressure. The recommendation of ADR was reported to be  $\geq 25\%$ <sup>17</sup>. In this study, ADR of the E-C group was 30.4% and the quality of CS was maintained. In patients with BMI of  $<18.5$  or  $\geq 25$ , fewer cases of CS difficulty may be encountered if EGD is performed first. We believe that patient pain, associated with the examination, and safety such as sedative dose, must be evaluated to determine whether EGD or CS should be performed first<sup>9,10,18</sup>.

Our study had some limitations. First, it was a single-center retrospective study with a small sample size. Second, only expert endoscopists were permitted to work with patients. Third, this study did not include water-assisted methods which are reported to affect CS insertion times<sup>19</sup>. Therefore, further studies are required to examine the effects of water-assisted methods when we performed same-day BDE. Fourth, the degree of sedation could not be confirmed. Since sleep quality during the examination has been reported as an



**Figure 3 Correlation between EGD examination times and colonoscope insertion times.** No correlations were observed between EGD examination times and colonoscope insertion times.

independent predictor of prolonged insertion time<sup>1</sup>, further studies are required to examine the sleep quality and patient pain during EGD and CS. Thirdly, we had not clearly decided whether to use normal air or CO<sub>2</sub> during upper gastrointestinal endoscopy. It is necessary to investigate whether normal air or CO<sub>2</sub> have different effects on CS insertion time. Lastly, we examined difficult CS cases with BMI of  $<18.5$  and  $\geq 25$  together as BMI abnormal cases because of the small number of cases in this study. Further studies are required to examine each of these separately.

## Conclusion

In conclusion, there was no significant difference in the number of difficult CS cases between the E-C and CS only groups, and EGD examination time was not related to colonoscope insertion time. In patients with BMI of  $<18.5$  or  $\geq 25$ , fewer cases of CS difficulty might be encountered if EGD is performed first.

## COI declaration

The authors have no potential conflicts of interest.

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## 上下部消化管内視鏡検査における下部消化管内視鏡の挿入性の検討

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### 和文要約

**【背景】** 上部消化管内視鏡検査 (EGD), 下部消化管内視鏡検査 (CS) を同日に施行する際に, 既報ではEGDを先行してもCSの挿入時間に変化はなかったと報告されているが, 日本の施設からの報告はない. 今回EGD, CSを同日に施行する際, EGDを先行するとCSの内視鏡挿入が困難になるのか明らかにすることを目的とした.

**【方法】** 2020年5月から8月までに鹿児島県立大島病院でEGDを先行したEGD+CS (以下E-C群とする) 61例およびCSのみを施行した (以下CS単独群とする) 120例を対象とした. 挿入困難例の定義については, CS単独群での挿入時間中央値が326.5秒であったことから, 挿入時間650秒以上の症例とした

**【結果】** 挿入困難症例数は, E-C群: 4例 (6.6%), CS単独群: 17例 (14.2%) で両群間に有意差はなかった ( $p = 0.131$ ). さらに, EGDの検査時間とCSの内視鏡挿入時間の相関係数は  $\rho = 0.09$  であり, 相関はなかった. また, BMI 18.5未満と25以上の症例において, 挿入困難症例数はE-C群がCS単独群と比較して有意に少なかった ( $p = 0.038$ ).

**【結論】** EGDとCSを同日に連続して施行する際は, EGDを先行してもCSの内視鏡挿入が必ずしも困難になるとはいえず, 既報と同様の結果であった. BMI 18.5未満や25以上の症例においては, EGDを先行するとCSの挿入が容易になる可能性がある.