Sigmoid colon diverticulosis with stenosis: case report and review of the Japanese literature

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Abstract
We treated a 68-year-old woman for stenosis arising from colonic diverticulosis. Two years previously, she had developed diverticulitis of the sigmoid colon, received conservative treatment, and was being carefully watched at another hospital. She began to experience irregular bowel movements and thus visited our hospital. Detailed examination showed circumferential stenosis of the colon, and passage of the endoscope could not be achieved. We suspected stenosis due to diverticulosis of the sigmoid colon. However, because FDG-PET/CT showed pathologic uptake and because of the change in the patient’s bowel habits, malignancy could not be ruled out, so surgery was performed. We observed circumferential thickening of the wall of the sigmoid colon and severe adhesion to the surrounding organs. Again, malignancy could not be ruled out, so sigmoidectomy with lymph node dissection was performed. Histopathologic examination revealed multiple diverticula, inflammatory cell infiltration into the intestinal wall, and thickening of the intestinal wall, but no malignant cells. Stenosis resulting from diverticulosis of the sigmoid colon was thus diagnosed. The postoperative clinical course was satisfactory, and the patient was discharged on postoperative day 11. Colon diverticulosis is a common condition, but instances of stenosis are rare, and the symptoms can be difficult to differentiate from those of colon cancer. We report this case in the hope that it will be a useful addition to the reference literature.

Key words
Colon diverticulosis, Stenosis

Introduction
The incidence of colon diverticulosis has increased in Japan in recent years. In many cases, diverticulosis remains asymptomatic throughout the patient’s lifetime. However, surgery can be required for complications such as perforation, bleeding, and stenosis. Here-in, we report a case of sigmoid colon diverticulosis with symptomatic stenosis. We hope that our experience will contribute in a small way to discussions of this topic in the literature.

Case presentation
Patient: 68-year-old woman.
Chief complaint: Irregular bowel movements.
Medical history: Pulmonary tuberculosis (approximately 20 years previously), Caesarean section, appendectomy for appendicitis.
History of present illness: Two years previously, the patient was treated conservatively at another hospital for diverticulitis of the sigmoid colon. Stenosis of the sigmoid colon was noted at that time. However, the patient was asymptomatic, so her condition was sim-
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Upon development of irregular bowel movements, she came to our hospital for a detailed examination and further treatment.

**Status at initial visit:** Height, 147 cm; body weight, 38 kg; abdomen smooth and soft, no spontaneous pain or pain on pressure.

**Blood test results:** WBC, 8100/uL; RBC, 352 × 10^4/uL; Hb, 10.5 g/dL; Hct, 31.7%; CRP, 0.2 mg/dL; TP, 6.5 g/dL, Alb, 3.7 g/dL; mild anemia, and poor nutritional status.

**Tumor marker levels:** CEA, 0.9 ng/mL (normal, ≤5.0 ng/mL); CA19–9, 27.0 U/mL (normal, 37.0 U/mL).

**Barium enema findings:** Multiple diverticula in the sigmoid colon, circumferential stenosis of approximately 7 cm. Aside from diverticula in parts of the ascending colon, no other protruding lesion, ulcer, or strangulation was found (Fig. 1).

**Lower gastrointestinal endoscopy findings:** Multiple diverticula in the sigmoid colon and a stenotic lesion were found, but we were unable to pass a fiberoptic endoscope through to the lesion. No ulcer was found. The large intestinal mucosa from the anal verge to the constricted portion was normal in color, and no lesion was found. There was no obvious bleeding.

**Biopsy findings:** Detailed analysis of a biopsy specimen of the constricted portion of the large bowel revealed a Group I (Fig. 2).

**Abdominal CT findings:** Diverticula in the sigmoid colon, thickening of the bowel wall, lymphadenopathy.

**Positron emission tomography (PET)/CT findings:** Accumulation of fluorodeoxyglucose (FDG) was observed in the sigmoid colon; SUV_{MAX} = 3.5~4.3.

A lesion was found only in the sigmoid colon. No lesion was found in the large intestinal mucosa at sites we were able to observe. The patient's only symptom was irregular bowel movements. There was no abdominal pain or melena. Blood chemistry tests showed no increase in inflammatory markers. Thus, we considered the possibility of strangulation due to inflammatory bowel disease to be low. Although the patient had previously suffered tuberculosis, the infection had fully resolved, and there was no abnormal shadow on the chest X-ray. We ruled out the possibility of intestinal tuberculosis; the strangulated portion of the intestine was about 7 cm long. Therefore, we suspected strangulation due to a sigmoid colon diverticulum, but a malignant tumor such as a type 4 colorectal cancer could not be ruled out. Thus, we performed surgery (Fig. 3).

Surgery was initiated laparoscopically. Initially, circumferential thickening of the wall of the sigmoid colon and severe adhesion to the surrounding organs were noted. Because of the possibility of injury to the surrounding organs, the procedure was converted to open abdominal surgery. The bowel was dissected to the portion of the colon unaffected by inflammation,
and sigmoidectomy was performed. Because malignancy could not be ruled out, D3 lymph node dissection was also performed.

**Macroscopic appearance of the surgical specimen:**
We observed severe thickening and poor distensibility of the intestinal wall; mucosal surfaces showed no neoplastic lesions, but multiple diverticula were present (Figs. 4, 5).

**Histopathologic findings:** There were no signs of malignancy; multiple diverticula extending into the subserosa and some areas of inflammatory cell infiltration and fibrosis were present (Fig. 6).

The final diagnosis was stenosis due to diverticulosis of the sigmoid colon. The postoperative clinical course was satisfactory, and the patient was discharged on postoperative day 11.

**Discussion**

The incidence of large intestine diverticulosis in Japan is of concern. Although still less common than in the West (30% to 40% in the West vs. 10% to 20% in Japan), incidence in Japan is on the rise. According to Yoshino et al., approximately 40% of barium X-ray examinations reveal diverticula in the colon, and the incidence of left colon diverticula, in particular, is age-related. In general, 70% to 85% of persons with diverticulosis remain asymptomatic throughout their lives, so it is difficult to determine the total number of cases and the incidence of this condition. When symptoms are present, they are mild in 25% of cases (including abdominal pain, abdominal bloating, and irregular bowel movements), and severe in 15% (including diverticulitis, abscess, fistula, stenosis, and
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Keywords “colon diverticulosis” and “stenosis.” We found 27 reports of the clinical course in cases in which stenosis was caused by colon diverticula. We reviewed these reports as well as our own case, for a total of 28 cases (Table 1). The mean age was 59.5 years (32 to 81 years). Male patients predominated, with a 21:7 ratio of men to women. The stenotic region was in the sigmoid colon in 71% of patients (cecum in 2 cases, ascending colon in 1 case, transverse colon in 2 cases, descending colon in 3 cases, and sigmoid colon in 20 cases). Complications developed in 17 patients. The most common was fistulization (10 cases), including colovesical fistula (2 cases), colouterine fistula (2 cases), coloureteral fistula (1 case), coloenteric fistula (1 case), colocolic fistula (1 case), colocolic fistula (1 case), and internal fistula (1 case). Nutritional status was recorded for 11 patients and was noted as inadequate or poor in 6 of the 11 patients (55%). Although not specifically related to cases of stenosis, a review of risk factors for postoperative complications following emergency surgery for colon diverticulitis has shown serum albumin < 3.0 to be a risk factor. Thus, particular care should be paid to preoperative nutritional management in cases involving factors such as stenosis-induced irregular bowel movements and inflammation that can result when nutritional status is poor. In our case, preoperative nutritional management included the use of an enteral nutrition formula.

The preoperative diagnosis was malignancy or suspected malignancy in 10 of the 28 cases (35.7%) we reviewed. Rowe et al. offer an identifying feature for differentiation between stenosis and malignancy upon barium enema: an elongated stenotic segment. In the 9 cases for which length of the stenotic colon segment was reported, the mean was 7.4 cm (5 cm to 12 cm). However, in type 4 (diffuse infiltrative type) colon cancer, the stenotic colon segment can be as long as that in diverticulosis-induced stenosis, making it difficult to distinguish between type 4 colon cancer and diverticulitis-induced stenosis. In such cases, it is difficult to identify the condition solely on the basis of length of the stenosis. This highlights the importance of monitoring for the presence or absence of peristalsis in the colon during the barium enema examination because patients with type 4 colon cancer are unlikely to show peristaltic movement in the stenotic segment. Recent reports have also described the usefulness of FDG-PET/CT in the diagnosis of malignancy. Findings from such...
Table 1. Cases of Stenosis Due to Colon Diverticulosis Reported in Japan.

<table>
<thead>
<tr>
<th>Case</th>
<th>Author</th>
<th>Year</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Location</th>
<th>Complication(s)</th>
<th>Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Maeda et al&lt;sup&gt;[8]&lt;/sup&gt;</td>
<td>1998</td>
<td>45 F</td>
<td>S</td>
<td>Coloureteral fistula</td>
<td>Nephroureterectomy, left hemicolecotomy</td>
<td></td>
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<tr>
<td>4</td>
<td>Nakayama et al&lt;sup&gt;[9]&lt;/sup&gt;</td>
<td>2000</td>
<td>74 M</td>
<td>S</td>
<td>CMSEP</td>
<td>Sigmoidectomy</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Uchida et al&lt;sup&gt;[10]&lt;/sup&gt;</td>
<td>2001</td>
<td>35 M</td>
<td>C</td>
<td>CMSEP, Small intestinal fistula</td>
<td>Ileocecal resection</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Furukawa et al&lt;sup&gt;[12]&lt;/sup&gt;</td>
<td>2002</td>
<td>69 F</td>
<td>S</td>
<td>Colouterine fistula</td>
<td>Sigmoidectomy, total hysterectomy</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Arai et al&lt;sup&gt;[13]&lt;/sup&gt;</td>
<td>2003</td>
<td>51 M</td>
<td>A</td>
<td>Actinomycosis</td>
<td>Right hemicolecotomy</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ikeuchi et al&lt;sup&gt;[14]&lt;/sup&gt;</td>
<td>2003</td>
<td>67 F</td>
<td>D</td>
<td>—</td>
<td>Colectomy</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Saji et al&lt;sup&gt;[15]&lt;/sup&gt;</td>
<td>2004</td>
<td>79 M</td>
<td>D</td>
<td>—</td>
<td>Colectomy</td>
<td></td>
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<tr>
<td>11</td>
<td>Tazawa et al&lt;sup&gt;[16]&lt;/sup&gt;</td>
<td>2005</td>
<td>51 M</td>
<td>S</td>
<td>—</td>
<td>Sigmoidectomy</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Sasanuma et al&lt;sup&gt;[17]&lt;/sup&gt;</td>
<td>2006</td>
<td>70 M</td>
<td>S</td>
<td>Hydronephrosis</td>
<td>Low anterior resection</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Ishido et al&lt;sup&gt;[18]&lt;/sup&gt;</td>
<td>2006</td>
<td>52 M</td>
<td>T-D</td>
<td>—</td>
<td>Subtotal colectomy</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Sekine et al&lt;sup&gt;[19]&lt;/sup&gt;</td>
<td>2006</td>
<td>81 F</td>
<td>S</td>
<td>Colouterine fistula</td>
<td>Colostomy</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Nishimura et al&lt;sup&gt;[20]&lt;/sup&gt;</td>
<td>2007</td>
<td>32 M</td>
<td>S</td>
<td>Vescosigmoid fistula</td>
<td>Laparoscopic-assisted sigmoidectomy</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Toyoda et al&lt;sup&gt;[21]&lt;/sup&gt;</td>
<td>2007</td>
<td>51 M</td>
<td>S</td>
<td>—</td>
<td>Laparoscopic sigmoidectomy</td>
<td></td>
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<tr>
<td>17</td>
<td>Ohishi et al&lt;sup&gt;[22]&lt;/sup&gt;</td>
<td>2008</td>
<td>62 F</td>
<td>S</td>
<td>Inflammatory pseudotumor</td>
<td>Sigmoidectomy</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Tanaka et al&lt;sup&gt;[23]&lt;/sup&gt;</td>
<td>2008</td>
<td>59 M</td>
<td>S</td>
<td>Colovesical fistula</td>
<td>Low anterior resection, total cystectomy, vesicstomy</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Monguchi et al&lt;sup&gt;[24]&lt;/sup&gt;</td>
<td>2008</td>
<td>44 M</td>
<td>D</td>
<td>Colocutaneous fistula</td>
<td>Colectomy</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Takaku et al&lt;sup&gt;[25]&lt;/sup&gt;</td>
<td>2009</td>
<td>61 M</td>
<td>S</td>
<td>—</td>
<td>Laparoscopic → open left hemicolecotomy</td>
<td></td>
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<tr>
<td>21</td>
<td>Yasuoka et al&lt;sup&gt;[26]&lt;/sup&gt;</td>
<td>2010</td>
<td>37 M</td>
<td>T</td>
<td>Coloduodenal fistula</td>
<td>Subtotal colectomy</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Otani et al&lt;sup&gt;[27]&lt;/sup&gt;</td>
<td>2010</td>
<td>77 M</td>
<td>S</td>
<td>Intestinal fistula</td>
<td>Colectomy</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Furukawa et al&lt;sup&gt;[28]&lt;/sup&gt;</td>
<td>2011</td>
<td>53 M</td>
<td>G</td>
<td>Inflammatory fibroid polyp</td>
<td>Ileocecal resection</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Furuhata et al&lt;sup&gt;[29]&lt;/sup&gt;</td>
<td>2011</td>
<td>66 M</td>
<td>S</td>
<td>—</td>
<td>Laparoscopic-assisted sigmoidectomy</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Higashi et al&lt;sup&gt;[31]&lt;/sup&gt;</td>
<td>2012</td>
<td>75 M</td>
<td>S</td>
<td>—</td>
<td>Sigmoidectomy, excision of merged small intestine/bladder wall</td>
<td></td>
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<tr>
<td>27</td>
<td>Kudo et al&lt;sup&gt;[32]&lt;/sup&gt;</td>
<td>2013</td>
<td>80 F</td>
<td>S</td>
<td>—</td>
<td>Sigmoidectomy</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Shimamura et al*</td>
<td>2014</td>
<td>68 F</td>
<td>S</td>
<td>—</td>
<td>Laparoscopic → open sigmoidectomy</td>
<td></td>
</tr>
</tbody>
</table>

*present case  ※CMSEP: colonic muco-submucosal elongated polyp
C: cecum; A: ascending colon; T: transverse colon; D: descending colon; S: sigmoid colon
examinations are reported in 3 cases, including ours.27,28) Of these, 1 case showed inflammatory changes, but high uptake was observed in the other 2 cases. In our patient, physical examination and blood chemistry tests showed no indication of inflammation, but FDG-PET/CT showed high uptake of the tracer in the sigmoid colon. SUVmax was 3.5 to 4.3 and was one factor that caused us to suspect malignancy. In a case described by Otani, et al.,27) who performed PET/CT before surgery, the WBC was elevated to 7900/μL, CRP was elevated to 2.0 mg/dL, a slight inflammatory reaction was found, and high FDG uptake was observed in the lesion.

Our search of the literature yielded no report on a relation between high FDG uptake and an inflammatory reaction related to diverticulosis. However, in a report of PET/CT of colorectal cancer, sensitivity was reported to be 95% to 100%, specificity was reported to be low at 43%, and positivity for adenomas 13 mm or larger was 90%.35) Thus, at present, it is considered difficult to differentiate between malignancy and strangulation by a colonic diverticulum on the basis of PET/CT. One or more studies involving a greater number of cases, blood chemistry analysis, and SUVmax values are needed to determine whether there is a definitive method for diagnosing diverticulosis-induced stenosis. As noted above, diagnosis based entirely on imaging findings is often quite unreliable. Instead, an overall diagnosis that takes into account the patient’s clinical course and laboratory test results is required.

The treatment plan included surgery in all 28 reported cases. In recent years, there have been a number of reports of laparoscopic management, and laparoscopic surgery was selected for 5 of the 28 patients. However, in 2 cases (including ours),25) severe adhesion to the surrounding organs was noted, and the procedure was converted to open abdominal surgery. In addition, in 5 of the 28 cases, en bloc resection of surrounding organs was implemented due to severe adhesions or a diagnosis of malignancy. This resulted in a highly invasive procedure. Diverticulosis-induced stenosis is basically a benign condition, so it is desirable to avoid highly invasive approaches. In the future, we can expect an increase in laparoscopic surgeries, but we must remain aware of the potential for injury to the surrounding organs.

**Conclusion**

When stenotic lesions are noted in the colon, there is a possibility (although rare) that the stenosis is due to diverticulosis. Because such cases can be difficult to diagnose, particular care should be exercised in determining a treatment plan.

**References**


33) Wada T, Yamagishi S, Momiyama M, Harada S, Satou S, Matsuo K, Nakano A. Objectives: In order to Investigate Appropriate Surgery Procedures, We Evaluated the Postoperative Compli-
