Clinical Features and Factors Associated With Surgical Treatment in Patients With Complicated Colonic Diverticulitis

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Purpose: Colonic diverticulitis is uncommon in Korea, but the incidence is rapidly increasing nowadays. The clinical features and the factors associated with complications of diverticulitis are important for properly treating the disease.

Methods: A retrospective review of the medical records of 225 patients that were prospectively collected between October 2007 and September 2016 was conducted.

Results: Diverticulitis was detected mainly in men and women aged 30 to 50 years. Diverticulitis more frequently affected the right colon (n = 194, 86.2%), but age was higher in case of left colonic involvement (42 years vs. 57 years, P < 0.001). Percentages of comorbidities (65.6% vs. 23.8%, P < 0.001), complications (65.6% vs. 6.2%, P < 0.001), and surgical treatment (50.0% vs. 4.1%, P < 0.001) were significantly higher in patients with left colonic diverticulitis. In the multivariate analysis, a risk factor for complicated diverticulitis was left colonic involvement (P < 0.001; relative risk [RR], 47.108; 95% confidence interval [CI], 12.651–175.413). In complicated diverticulitis, age over 50 was the only significant risk factor for surgical treatment (P = 0.024; RR, 19.350; 95% CI, 1.474–254.023).

Conclusion: In patients over 50 years of age with left colonic diverticulitis, a preventive colectomy should be reconsidered as one of the options for treatment.

Keywords: Colonic diverticulitis; Complicated diverticulitis; Clinical characteristics; Risk factor; Surgical treatment

INTRODUCTION

Diverticulosis is the most common benign colonic disease. In people below 40 years of age, diverticulosis has a prevalence rate of less than 10%, but that rate increases to 30% for people in the age bracket from 40 to 60 and to 50%–70% for people 80 years of age and older [1, 2]. Diverticular diseases, such as diverticulitis, abscess, perforation, peritonitis, fistula, obstruction, and hemorrhage [3], develop later in life in approximately 20% of patients with diverticulosis [4].

Acute colonic diverticulitis is a structural disease of the colon that is common in Western societies [4]. In the United States, in 2004, diverticular disease ranked as the 3rd most common gastrointestinal diagnosis among patients discharged from the hospital. Additionally, diverticular disease was the 4th most common reason patients were provided with outpatient care [1]. However, an increase in the incidence of colonic diverticulitis in Asia, including South Korea, has been observed. Eating habit changes in Asian populations, as well as reduced physical activity, industrialization, and increasing mean age, are thought to be associated with the increasing incidence of colonic diverticulitis in those populations [3, 5-8].

With the use of computed tomography (CT evaluation), diverticulitis can be categorized as complicated or uncomplicated. Patients with complicated diverticulitis often present with abscesses, fistulas, obstructions, and/or localized or free perforations whereas those with uncomplicated diverticular disease exhibit colonic wall thickening or pericolic inflammatory changes [3].
These complications of colonic diverticulitis are considered important because of their clinical and socioeconomic burden. An increase in the prevalence of diverticular disease can lead to more hospital visits [9], and the severity of the disease can affect the admission rates and the lengths of hospital stay [2].

In terms of both mortality and cost, diverticular disease, as well as the complications of the disease, can be a burden to patients who are diagnosed with it [10]. However, not many studies assessing the factors associated with diverticular complications in Asian populations have been published [5], although the characteristics of diverticular disease in Asian societies appear to be different from those in Western societies. For that reason, this study aimed to investigate in the Korean population the clinical characteristics and the factors responsible for the complications of diverticulitis.

METHODS

From October 2007 to December 2016, 536 patients visited Hanyang University Guri Hospital because of suspicion of acute colonic diverticulitis. Clinical diagnoses were based on symptoms, physical examinations, and blood tests. Most patients underwent CT or ultrasonography. The CT scan criteria for the diagnosis of diverticulitis included localized thickening of the colonic wall to ≥5 mm and signs of inflammation of pericolic fat, with or without abscess formation and/or extraluminal air and/or extraluminal contrast [11]. The ultrasound criteria were an inflamed diverticulum with pericolic infiltration (a hypoechoic line surrounding the diverticulum) and increased echogenicity of the adjacent pericolic fat [12]. Of the 536 patients, the diagnoses for 24 patients were not biopsy-proven during surgery, and those for 201 were confirmed by colonoscopic findings. Patients without evidence of diverticulitis on the CT scan were excluded from the study.

This study was a retrospective analysis of prospectively collected medical records. This study was approved by the Institutional Review Board of Hanyang University, Guri Hospital (approval number: 2017-08-016-001). Written informed consent was not needed due to the study being retrospective. Conservative management included antibiotic use, fluid resuscitation, and fasting. Food intake was permitted if laboratory findings such as leukocytosis and C-reactive protein had disappeared or the patient’s symptoms had improved. After being able to tolerate food, patients were discharged unless their symptoms interfered with daily life. Surgical treatment was necessitated if the patient had complicated diverticulitis or generalized peritonitis. Furthermore, patients who had concerns, even when the condition was diverticulitis without complications, were treated surgically. All patients with surgical treatment underwent a resection of the involved colon.

Continuous variables are reported as means and standard deviations. All data analyses were performed using IBM SPSS ver. 18.0 (IBM Co., Armonk, NY, USA). The significance of the differences between the pairs of groups was tested using the Student t-test or Fisher exact test. Variables with P-values < 0.05 on the univariate analysis were further analyzed using the Cox regression method for a multivariate analysis.

RESULTS

Clinical characteristics of patients with acute diverticulitis

The characteristics of the patients with diverticular disease who were recruited for this study are shown in Table 1. The mean age of the patients was 44 years; 53.8% of the patients were women, and 38.2% of the recruited patients were smokers. The most common site for diverticulitis was the right colon. Of the 536 patients, the diagnoses for 24 patients were not biopsy-proven during surgery, and those for 201 were confirmed by colonoscopic findings. Patients without evidence of diverticulitis on the CT scan were excluded from the study.

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(18.2%) were diagnosed with recurrent diverticulitis. Six patients (2.7%) were admitted with the 3rd attack of diverticulitis. Thirty-three patients (14.7%) suffered from complications of diverticular disease, among which 20 underwent surgical treatment. Fig. 1 shows the ages of the patients at the onset of acute colonic diverticulitis. Acute diverticulitis was detected mainly among men and women in their 30s and 40s.

Recurrent diverticulitis does not influence the complications or surgical treatment in patients with colonic diverticulitis. Also, 5 out of the 41 patients (12.2%) with recurrent episodes of diverticulitis underwent surgery, and 19 out of the 184 patients (10.3%) who were diagnosed for the first time with diverticulitis had surgical treatment. Except for leukocytosis (73.4% vs. 56.1%, P = 0.029), no statistical differences between patients with nonrecurrent diverticulitis and those with recurrent diverticulitis were noted (Supplementary Table 1).

### Clinical characteristics of patients with complicated acute diverticulitis

In this study, patients who were diagnosed with complicated diverticulitis were older (42 years vs. 53 years, P < 0.001) and had a higher rate of disease involving the left colon (5.7% vs. 63.6%, P < 0.001). More patients with complicated diverticulitis underwent surgery than patients who had diverticulitis without complications (60.6% vs. 2.1%, P < 0.001). Leukocytosis was significantly higher in the patients with complicated diverticulitis (90.9% vs. 66.7%, P = 0.005) (Table 2). In the multivariate analysis, left colonic diverticulitis was the only significant risk factor for complicated diverticulitis (P < 0.001; relative risk [RR], 47.108; 95% confidence interval [CI], 12.651–175.413) (Table 3).

### Differences in clinical characteristics between patients with left-sided diverticulitis and patients with diverticulitis at other locations

Of the 225 patients with diverticulitis, 32 had diverticulitis involv-
ing the left colon, and 193 had diverticulitis at other locations. Patients with left-sided diverticulitis were older (42 years vs. 57 years, P < 0.001). Furthermore, patients with left-sided diverticulitis were less likely to be consumers of alcohol (37.5% vs. 57.0%, P = 0.040), had more comorbidities (65.6% vs. 23.8%, P < 0.001), had higher rates of leukocytosis (87.5% vs. 67.4%, P = 0.021), had higher rates of complications (65.6% vs. 6.2%, P < 0.001), and underwent more surgical treatments (50.0% vs. 4.1%, P < 0.001) (Table 4).

Clinical characteristics of patients who underwent surgical treatment for complicated diverticulitis

Of the patients with diverticular complications, 13 were treated conservatively, and 20 were treated surgically. The mean age of the 20 patients who underwent surgery was significantly higher than that of the patients who did not undergo surgery (58 years vs. 47 years, P = 0.013) (Table 5). From the multivariate analysis, age over 50 years was the only risk factor for surgical treatment of diverticulitis with complications (P = 0.024; RR, 19.350; 95% CI, 1.474–254.023) (Table 6).

DISCUSSION

From our retrospective review, acute diverticulitis was mainly detected in men and women in their 30s and 40s, a relatively young age compared to the ages reported in previous studies [5]. Right colonic diverticulitis occurred more often than left colonic diverticulitis, and complicated diverticulitis was higher in the patients with left colonic diverticulitis. Surgical treatment of complicated diverticulitis was more often performed in older patients over 50 years old, which might have been due to their clinical deteriora-

Table 5. Clinical characteristics of patients undergoing surgical treatment for complicated diverticulitis

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Conservative management (n = 13)</th>
<th>Surgical treatment (n = 20)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex, women : men</td>
<td>5 (38.5) : 8 (61.5)</td>
<td>10 (50.0) : 10 (50.0)</td>
<td>0.515</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>47 ± 14</td>
<td>58 ± 10</td>
<td>0.013</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>24.18 ± 4.45</td>
<td>24.93 ± 3.34</td>
<td>0.585</td>
</tr>
<tr>
<td>Smoking</td>
<td>5 (38.5)</td>
<td>9 (45.0)</td>
<td>0.710</td>
</tr>
<tr>
<td>Alcohol</td>
<td>7 (53.8)</td>
<td>8 (40.0)</td>
<td>0.435</td>
</tr>
<tr>
<td>Comorbidities</td>
<td>5 (38.5)</td>
<td>9 (45.0)</td>
<td>0.710</td>
</tr>
<tr>
<td>High fever</td>
<td>2 (15.4)</td>
<td>2 (10.0)</td>
<td>1.000</td>
</tr>
<tr>
<td>Leukocytosis</td>
<td>11 (84.6)</td>
<td>19 (95.0)</td>
<td>0.547</td>
</tr>
<tr>
<td>Left colon involvement</td>
<td>6 (46.2)</td>
<td>15 (75.0)</td>
<td>0.142</td>
</tr>
<tr>
<td>No. of previous episodes</td>
<td>0.3 ± 0.5</td>
<td>0.1 ± 0.3</td>
<td>0.183</td>
</tr>
<tr>
<td>Recurrent diverticulitis</td>
<td>4 (30.8)</td>
<td>2 (10.0)</td>
<td>0.182</td>
</tr>
</tbody>
</table>

Values are presented as number (%) or mean ± standard deviation.

Table 6. Multivariate analysis of the risk factors for surgical treatment of patients with complicated diverticulitis

<table>
<thead>
<tr>
<th>Parameters</th>
<th>P-value</th>
<th>RR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, ≥50 yr vs. &lt;50 yr</td>
<td>0.024</td>
<td>19.350</td>
<td>1.474–254.023</td>
</tr>
<tr>
<td>Comorbidities, yes vs. no</td>
<td>0.243</td>
<td>0.268</td>
<td>0.029–2.447</td>
</tr>
<tr>
<td>Left colon involvement, yes vs. no</td>
<td>0.341</td>
<td>2.864</td>
<td>0.329–24.969</td>
</tr>
<tr>
<td>Recurrent diverticulitis, yes vs. no</td>
<td>0.196</td>
<td>0.218</td>
<td>0.022–2.197</td>
</tr>
</tbody>
</table>

RR, relative risk; CI, confidence interval.

The disease paradigm of diverticulitis, which was previously thought to be a disease of the "old," has changed. The incidence of diverticular disease in younger patients has increased during the last decade [1, 13]. A study demonstrated that over the recent past, the number of patients younger than 50 years of age with diverticulitis has risen significantly [6], which correlates with the findings of our study. The prevalence of young diverticular patients is thought to be due mainly to changes in dietary habits and lifestyle [6].

Consistent with our study, recent studies showed a right-side preponderance of diverticular diseases in the Asian populations [14]. In contrast to Western populations, diverticular involvement in locations other than the left colon was observed to be more frequent in our study, and a recent study found right-sided diverticulitis to be predominant in Asia, including Korea [7, 15] and to be influenced by intraluminal pressure and content [16]. Right colonic diverticula are congenitally-formed true diverticula that are defined as sac-like, entire-bowel-wall herniations whereas left colonic diverticula, usually associated with secondary causes, are false diverticula involving only a mucosal and submucosal protrusion through the colonic muscularis propria [14].

In our study, left colon involvement, which is less common in Asia, was influenced by age and comorbidities. Even though recent publications have reported a dramatic rise in left-sided diverticulitis in younger age groups [13], differently from right-sided diverticulitis, left-sided diverticulitis is well known to depend strongly on age [3], indicating that left-sided diverticulitis is an acquired disease. Changes in dietary habits, increased colonic pressure, defecation habits, and irritable bowel syndrome are some of the secondary causes that are responsible for left-sided diverticular diseases [14].

With increasing age, people tend to have more comorbidities than younger versions of themselves, and in accordance with our study and other recent research, older patients with more comorbidities have greater odds of left-sided diverticulitis, which has an increased tendency of complications. Furthermore, the percentage of patients who underwent surgery was significantly higher for those with left colonic diverticulitis [1]. Right colonic involvement of the disease was more likely to be treated nonsurgically [17]. In our study, a significant age difference was found in the two groups of patients with complicated diverticulitis. In our
CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

SUPPLEMENTARY MATERIAL

Supplementary Table can be found via http://www.coloproctol.org/src/sm/ac-33-178-s001.pdf.

REFERENCES