



Management of Colonic Diverticulitis Tailored to Location and Severity: Comparison of Right and Left Colon

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Abstract

Aim: To assess optimal management of colonic diverticulitis as a function of location and disease severity, as well as factors associated with complicated diverticulitis.

Methods: This retrospective review analyzed 202 patients diagnosed with colonic diverticulitis by abdominopelvic CT between 2007 and 2014 at Chonbuk National University Hospital, South Korea. Diverticulitis location was determined, and disease severity categorized by modified Hinchey classification.

Results: The 202 patients included 108 males (53.5%) and 94 females (46.5%); of these, 167 patients (82.7%) were diagnosed with right-sided and 35 (17.3%) with left-sided colonic diverticulitis. Of the 167 patients with right-sided colonic diverticulitis, 12 (7.2%) had complicated and 155 (92.8%) had uncomplicated diverticulitis; of these, 157 patients (94.0%) were successfully managed conservatively. Of the 35 patients with left-sided colonic diverticulitis, 23 (65.7%) had complicated and 12 (34.3%) had uncomplicated diverticulitis; of these, 23 patients (65.7%) were managed surgically. Among patients with right-sided diverticulitis, those with complicated disease were significantly older (54.3 ± 12.7 versus 42.5 ± 13.4 years, $p=0.004$) and more likely to be smokers (66.7% versus 32.9%, $p=0.027$) than those with uncomplicated disease. However, among patients with left-sided diverticulitis, those with complicated disease had significantly lower body mass index (BMI; 21.9 ± 4.7 versus 25.8 ± 4.3 kg/m², $p=0.021$) than those with uncomplicated disease.

Conclusion: Conservative management may be effective in patients with right-sided diverticulitis, as well as in patients with uncomplicated left-sided colonic diverticulitis. Surgical management may be required for patients with complicated left-sided diverticulitis. Factors associated with complicated diverticulitis include older age, smoking and lower BMI.

Keywords: Diverticulitis; Colonic; Computed tomography; Anti-Bacterial Agents/Therapeutic Use; Treatment outcome; Risk factors

Introduction

The incidence of colonic diverticulitis is increasing, both in Asian and Western countries. This increase may be due to improvements in diagnostic tools, such as abdominopelvic computed tomography (CT), which can provide detailed diagnosis of diverticulitis between the different variants of disease progression [1,2]. Diverticulitis can be classified as uncomplicated or complicated by CT evaluation. Uncomplicated diverticulitis is characterized by evidence of colonic wall thickening or pericolic inflammatory changes, whereas complicated diverticular disease is characterized by the presence of abscesses, fistulas, obstructions, and/or localized or free perforations. The severity of acute diverticulitis is often graded by the modified Hinchey classification [1-4]. Surgical management of diverticulitis has been questioned, with conservative management increasingly used in patients with diverticulitis in both the right and left colon. Moreover, surgery may not always be appropriate in patients with a complicated form of diverticulitis.

Few studies to date have compared management of patients with diverticulitis in the right and left colon. This study evaluated the management of diverticulitis as a function of disease location (right or left colon) and disease severity (complicated or uncomplicated). In addition, factors associated with complicated diverticulitis were determined.

Materials and Methods

Patients diagnosed with colonic diverticulitis by abdominopelvic CT at Chonbuk National University Hospital, South Korea, from 2007 to 2014 were retrospectively evaluated. Demographics

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Table 1: Characteristics of patients.

	Total (n=202)	Rt colon (n=167)	Lt colon (n=35)	p-value
Age, yr	47.2±16.3	43.4±13.7	65.8±15.4	.001
Gender (M/F)	108/94 (53.5/46.5)	97/70 (58.1/41.9)	11/24 (31.4/68.6)	.004
BMI	23.0±3.2	23.0±3.2	37.5±4.9	.732
Smoking	66 (32.7)	59 (35.3)	7 (20.0)	.079
Alcohol	84 (41.6)	76 (45.5)	8 (22.9)	.013
Comorbidity	75 (37.1)	53 (31.7)	22 (62.9)	.001
Constipation	6 (3.0)	4 (2.4)	2 (5.7)	.278
Recent BHC	34 (16.8)	26 (15.6)	8 (22.9)	.295
Body temperature (°C)	36.7±0.6	36.7±0.5	36.6±0.7	.589
WBC count (/mm ³)	12.0±7.9	12.0±8.0	11.7±7.8	.916
Tenderness	194 (96.0)	162 (97.0)	32 (91.4)	.144
Rebound tenderness	113 (55.9)	93 (55.7)	20 (57.1)	.875
Multiple diverticula	134 (66.3)	108 (64.7)	26 (74.3)	.274
mHinchey Classification				
Ia	167 (82.7)	155 (92.8)	12 (34.3)	.001
Ib	16 (7.9)	9 (5.4)	6 (17.1)	
II	3 (1.5)	1 (0.6)	2 (5.7)	
III	5 (2.5)	1 (0.6)	4 (11.4)	
IV	11 (5.4)	1 (0.6)	11 (31.4)	
Fistula	0 (0)	0 (0)	0 (0)	
Obstruction	0 (0)	0 (0)	0 (0)	
Abdominal PCD	5 (2.5)	3 (1.8)	2 (5.7)	.208
Surgery	33 (16.3)	10 (6.0)	23 (65.7)	.001
NPO time (day)	33.8±3.7	3.8±3.8	4.2±2.9	.490
Antibiotic duration (day)	6.4±5.0	5.8±4.1	9.1±7.7	.020
Hospital days	8.6±7.1	7.6±4.5	13.7 ±13.0	.008
Recurrence	20 (9.9)	16 (9.6)	4 (11.4)	.757

Data are presented as mean±SD or number (%). BMI: Body Mass Index (kg/m²); Constipation: Chronic Constipation; Recent BHC: Recent Bowel Habit Change; mHinchey Classification: Modified Hinchey Classification; PCD: Percutaneous Drainage; NPO: Nothing per Oral. BMI, Body temperature, WBC count was checked on admission.

Table 2: Associated factors for location of diverticulitis (multivariate analysis).

	Rt colon (n=167)	Lt colon (n=35)	Multivariate OR	95% CI	p-value
Age, yr	43.4±13.7	65.8±15.4	1.104	1.069-1.142	.000
Gender (Female)	70 (41.9)	24 (68.6)	2.730	1.089-6.841	.032
Alcohol	76 (45.5)	8 (22.9)	0.903	0.270-3.018	.869
Comorbidity	53 (31.7)	22 (62.9)	0.797	0.282-2.254	.669

Logistic regression analyses are used. Data are presented as mean±SD or number (%)
OR: Odds Ratio; CI: Confidence Interval

and clinical features were obtained from patient records, including age, sex, results of physical examinations, body mass index (BMI), comorbidities, changes in bowel habits, length of hospital stay, duration of antibiotic use, bowel rest, CT findings, type of surgery, and disease recurrence. Abdominopelvic CT findings were categorized by the modified Hinchey classification, with patients classified as having stages Ib, II, III and IV diverticulitis, as well as fistula or obstruction, defined as having complicated diverticulitis [2]. Patients without CT scan evidence of diverticulitis were excluded from the study.

Categorical variables were compared by chi-square and Fisher's exact tests, whereas continuous variables were compared by Student's t-tests. Logistic regression analysis was used for multivariate analysis. P values < 0.05 were considered statistically significant.

Results

During the study period, 202 patients, 108 males (53.5%) and

94 females (46.5%) were diagnosed with diverticulitis, including 167 patients (82.7%) with right-sided and 35 (17.3%) with left-sided colonic diverticulitis. Patients with right-sided diverticulitis were significantly younger (43.4±13.7 versus 65.8±15.4 years, p=0.001), significantly more likely to be male (58.1% versus 31.4%, p=0.004) and significantly less likely to have comorbidities (31.7% versus 62.9%, p=0.013) than patients with left-sided diverticulitis. Other variables in these two groups are shown in (Table 1), and multivariate analysis of factors significantly associated with the location of diverticulitis is shown in (Table 2).

Statistical analysis showed that factors significantly associated with complicated diverticulitis were dependent on disease location. Compared with patients with uncomplicated right-sided diverticulitis, those with complicated right-sided diverticulitis were significantly older (54.3±12.7 versus 42.5±13.4 years, p=0.004) and were significantly more likely to be smokers (66.7% versus 32.9%,

Table 3: Associated factors with complicated diverticulitis in right colon.

	With complications (n=12)	Without complications (n=155)	p-value
Age, yr	54.3±12.7	42.5±13.4	.004
Gender (M/F)	8/4 (66.7/33.3)	89/66 (57.4/42.6)	.532
BMI	22.2±2.3	23.0±3.2	.384
Smoking	8 (66.7)	51 (32.9)	.027
Alcohol	8 (66.7)	68 (43.9)	.127
Comorbidity	4 (33.3)	49 (31.6)	.999
Constipation	0 (0.0)	4 (2.6)	.999
Recent BHC	2 (16.7)	24 (15.5)	.999
Body temperature (°C)	36.5±0.3	36.7±0.5	.111
WBC count (/mm ³)	11.8±3.6	12.0±8.2	.920
Tenderness	12 (100.0)	150 (96.8)	.999
Rebound tenderness	4 (33.3)	89 (57.4)	.106
Multiple diverticula	11 (91.7)	97 (62.6)	.058

Student's t-test, Chi-square test and Fisher's exact test are used. Data are presented as mean±SD or number (%).
OR: Odds Ratio; CI: Confidence Interval

Table 4: Associated factors with complicated diverticulitis in left colon.

	With complications (n=23)	Without complications (n=12)	p-value
Age, yr	68.2±12.5	61.2±19.6	.276
Gender (M/F)	9/14 (39.1/60.9)	2/10 (16.7/83.3)	.259
BMI	21.9±4.7	25.8±4.3	.021
Smoking	5 (21.7)	2 (16.7)	.999
Alcohol	5 (21.7)	3 (25.0)	.999
Comorbidity	14 (60.9)	8 (66.7)	.999
Constipation	1 (4.3)	1 (8.3)	.999
Recent BHC	5 (21.7)	3 (25.0)	.999
Body temperature (°C)	36.7±0.7	36.6±0.6	.852
WBC count (/mm ³)	12.7±9.1	10.3±4.2	.386
Tenderness	21 (91.3)	11 (91.7)	.999
Rebound tenderness	14 (60.9)	6 (50.0)	.537
Multiple diverticula	19 (82.6)	7 (58.3)	.220

Student's t-test, Chi-square test and Fisher's exact test are used. Data are presented as mean±SD or number (%).
OR: Odds Ratio; CI: Confidence Interval

p=0.027) (Table 3). However, among patients with left-sided diverticulitis, those with complicated disease had significantly lower body mass index (BMI; 21.9±4.7 versus 25.8±4.3 kg/m², p=0.021) than those with uncomplicated disease (Table 4).

Of the 172 patients with right-sided disease, 12 (7.2%) had complicated and 155 (92.8%) had uncomplicated diverticulitis. Of the 12 patients with complicated diverticulitis, seven were managed surgically and five were managed conservatively. Of the 155 patients with uncomplicated diverticulitis, 152 were successfully managed conservatively. The other three patients were initially managed conservatively, but eventually underwent surgery (Figure 1a).

Of the 35 patients with left-sided disease, 23 (65.7%) had complicated and 12 (34.3%) had uncomplicated diverticulitis. Of the 23 patients with complicated diverticulitis, 17 were managed surgically and six were initially managed conservatively. Three of the latter six patients, however, failed conservative management and eventually underwent surgery. Of the 12 patients with uncomplicated diverticulitis, nine were successfully managed conservatively, with

the remaining three patients requiring surgery (Figure 1b).

Discussion

This retrospective analysis suggests that management of patients with colonic diverticulitis is dependent on both disease location and severity. This analysis also identified clinicopathological factors associated with both disease location and disease severity.

The demographic and clinical characteristics of patients in the present study were similar to those in previous studies of diverticulitis. Right-sided colonic diverticulitis has been reported to occur predominantly in relatively young males, whereas left-sided diverticular disease is more common in women, with its incidence increasing with age [5-9]. The present study also found that left-sided colonic diverticulitis was significantly associated with both older age and female gender.

Diverticulitis in younger patients (<50 years) has been described as more virulent and more likely to be associated with complications [10,11]. In addition, smoking was found to be a risk factor in

Figure 1a

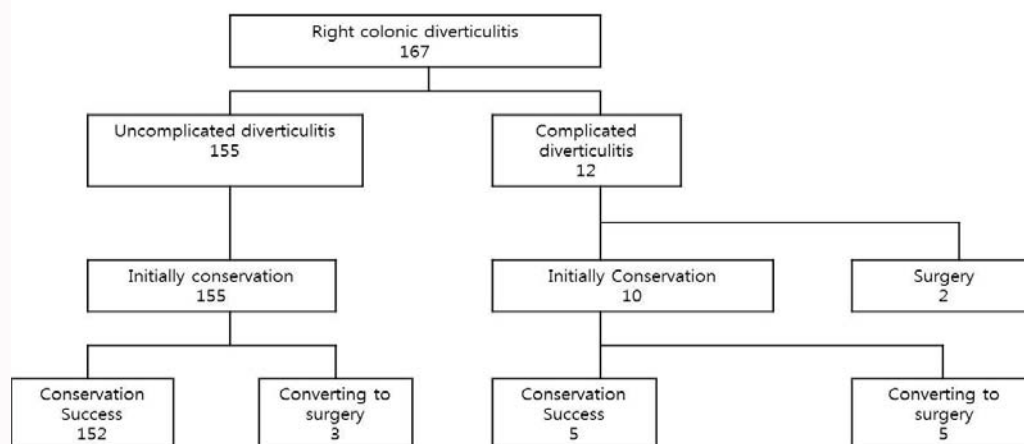
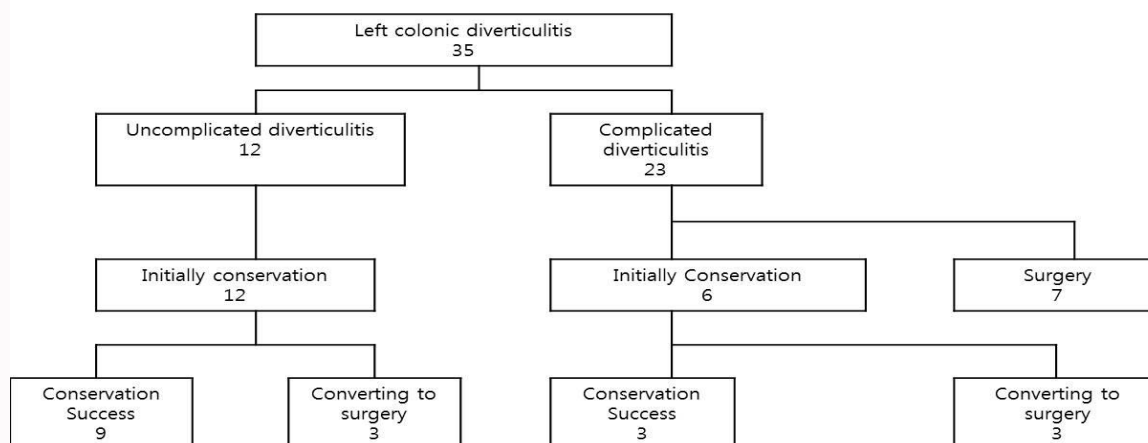


Figure 1b

**Figure 1:** Overview of patient outcomes.**1a:** In patients with right colonic diverticulitis.**1b:** In patients with left colonic diverticulitis.

patients with symptomatic disease and to be related to complications [12,13]. The present study found that older age and smoking were significantly associated with complicated right-sided diverticulitis, whereas low BMI was significantly associated with complicated left-sided diverticulitis. To our knowledge, no previous study has assessed factors associated with locations of complicated diverticulitis from the same population. The findings of this study suggest that special considerations may be required to manage patients with factors associated with complicated diverticulitis. These patients initially have uncomplicated diverticulitis, which becomes aggravated and complicated, resulting in a switch from conservative to surgical management. Additional large scale studies are required to confirm these findings, especially in patients with complicated left-sided diverticulitis.

Conservative management has been shown to be effective in patients with uncomplicated diverticulitis, both in the right and left colon [14-19]. However, the optimal treatment of complicated diverticulitis has not been determined, as improvements in surgical techniques and medical management have led to changes

in management. Traditionally, most patients with complicated diverticulitis were managed surgically, by, for example, resection of the perforated segment of the colon [20-23]. Conservative management of complicated diverticulitis has been reported successful [24,25]. Medical management in patients with complicated diverticulitis may have the goal of converting an emergency to an elective surgical situation [2,26,27].

The results of the present study suggest that conservative management may be effective in patients with right-sided colonic diverticulitis. Of the 155 patients with uncomplicated right-sided diverticulitis, 152 (98%) were treated conservatively, and only 12 (7%) of the 167 patients with right-sided diverticulitis had complicated disease. Of these 12 patients, only two required emergency surgery for acute peritonitis and sepsis. Three patients with uncomplicated and five with complicated right-sided diverticulitis were initially managed conservatively, but eventually underwent right hemicolectomy. A review of medical records and radiologic findings could not identify any criteria or indications for surgery in these patients, suggesting that these patients may have undergone unnecessary surgery, performed

at the discretion of a surgeon not specializing in colorectal surgery. These patients likely could have been managed conservatively.

Because the number of patients with left-sided colonic diverticulitis was relatively small, we could not determine any effective treatment modality. Our findings suggest, however, that conservative management may be effective for patients with uncomplicated diverticulitis, but that surgical management may be better for patients with complicated diverticulitis. Of the 23 patients with complicated left-sided diverticulitis, 20 (87%) underwent surgery, with 15 having Hinchey stage III or IV disease requiring emergency surgery.

This study had several limitations, including its retrospective design and its performance at a single tertiary center where almost all patients were Asian. Moreover, only inpatients were included; there were no outpatients with mild diverticulitis. Therefore, this study was limited in assessing the clinical features of all patients diagnosed with diverticulitis. In addition, the number of patients with left-sided diverticulitis was much smaller than the number with right colonic diverticulitis. Finally, this study did not evaluate the long-term effects of conservative management of diverticulitis, specifically recurrence rate.

In conclusion, conservative management may be effective in patients with right-sided colonic diverticulitis, whether complicated or uncomplicated, and in patients with uncomplicated left-sided diverticulitis. Patients with complicated left-sided diverticulitis may, however, require surgical management. In addition, special attention should be paid in managing patients with factors associated with complications, such as older age and smoking in patients with right-sided and low BMI in patients with left-sided complicated diverticulitis.

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