

Predictive factors for conservative treatment failure of right colonic diverticulitis

Youn Young Park¹, Soomin Nam², Jeong Hee Han³, Jaeim Lee¹, Chinock Cheong^{4,*}

¹Department of Surgery, Uijeongbu St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

²Department of Surgery, National Health Insurance Service Ilsan Hospital, Goyang, Korea

³Department of Surgery, Hallym University College of Medicine, Chuncheon, Korea

⁴Department of Surgery, Ajou University School of Medicine, Suwon, Korea

Purpose: Conservative treatment is the first-line therapy for acute colonic diverticulitis without severe complications, but treatment failure may increase hospitalization duration, medical costs, and morbidities. Usage of the modified Hinchey classification is insufficient to predict the outcome of conservative management. We aimed to investigate the clinical efficacy of the modified Hinchey classification and to evaluate predictive factors such as inflammatory markers for the failure of conservative management.

Methods: Patients diagnosed with right colonic diverticulitis undergoing conservative treatment at 3 hospitals between 2017 and 2019 were included. Patients were categorized into conservative treatment success (n = 494) or failure (n = 46) groups. Clinical characteristics and blood inflammatory markers were assessed.

Results: The conservative treatment failure group presented with more elderly patients (>50 years, P = 0.002), more recurrent episodes (P < 0.001), a higher lymphocyte count (P = 0.021), higher C-reactive protein (CRP) levels (P = 0.044), and higher modified Glasgow prognostic scores (P = 0.021). Multivariate analysis revealed that age of >50 years (odds ratio [OR], 2.54; 95% confidence interval [CI], 1.27–5.08; P = 0.008), recurrent episodes (OR, 4.78; 95% CI, 2.38–9.61; P < 0.001), and higher CRP levels (OR, 1.08; 95% CI, 1.03–1.12; P = 0.001) were predictive factors for conservative treatment failure, but not the modified Hinchey grade (P = 0.159).

Conclusion: Age of >50 years, recurrent episodes, and CRP levels are potential predictors for conservative management failure of patients with right-sided colonic diverticulitis. Further studies are warranted to identify candidates requiring early surgical intervention.

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Key Words: Colonic diverticulitis, Conservative treatment, C-reactive protein, Inflammatory response, Recurrence

INTRODUCTION

Colonic diverticular disease is commonly reported in Western industrialized countries [1]. The incidence of diverticular disease has increased in Asian countries, including Korea, owing to the westernization of diets and advancements in diagnostic tools in recent years [2].

The treatment strategy for colonic diverticulitis is determined based on the Hinchey radiological grades [3,4]. However, this classification has limitations regarding the estimation of symptom severity and prediction of conservative management failure among select patients. Compared to the cases reported in Western countries, right colonic diverticulitis cases are more commonly observed in Asian countries with approximately 70%

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Corresponding Author: Chinock Cheong

Department of Surgery, Ajou University School of Medicine, 164
WorldCup-ro, Yeongtong-gu, Suwon 16499, Korea

Tel: +82-31-219-7835, Fax: +82-31-219-5755

E-mail: owho9@naver.com

ORCID: https://orcid.org/0000-0002-7723-0053

*Current affiliation: Department of Surgery, Korea University Guro Hospital,
Korea University College of Medicine, Seoul, Korea.

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of the total diverticular disease [1,5]. Although most patients with right colonic diverticulitis are usually classified as low grade in accordance with the Hinchey classification and such patients are subjected to conservative treatment, conservative treatment failure has been reported among some patients showing the necessity of subsequent surgical treatment for index episodes.

Recent studies have investigated long-term outcomes after the conservative management of diverticulitis. A previous study reported that >30% of the patients presented with aggravated and recurrent symptoms, and a high mortality rate was observed after emergency colon resection during recurrent episodes [6]. Even among the patients not requiring surgical resection during recurrent episodes, patients incur high hospital expenses and exhibit a low quality of life [6,7]. Thus, the ability to predict conservative management failure would lead to the conduction of appropriate treatment among patients with colonic diverticulitis. The identification of factors predicting conservative treatment failure would facilitate early surgical treatment and reduce the morbidity and hospital costs after delayed management, while also improving their quality of life. This study aimed to investigate the clinical efficacy of the modified Hinchey classification and to evaluate factors predicting conservative management failure for right-sided colonic diverticulitis, including various inflammatory markers.

METHODS

Patients

We included patients hospitalized in the emergency department of 3 hospitals between January 2017 and May 2019, owing to the development of acute right colonic diverticulitis. All patients were diagnosed with right-sided colonic diverticulitis using abdominopelvic CT scanning. We

considered the first admission via the emergency department as an index event for this study, if a patient had been readmitted via the outpatient clinic for elective surgery to prevent further recurrent episodes. Thereafter, we excluded patients who needed an emergency operation owing to the development of panperitonitis with freely perforated colonic diverticulitis and those with a confirmed diagnosis of colon cancer after operation. After exclusion, all the patients were subjected to the conservative management according to Hinchey classification. There were no patients who needed percutaneous drainage in this study. Finally, 540 patients were included in the analysis. We categorized the patients into the conservative treatment success (n = 494) and conservative treatment failure (n = 46) groups to investigate risk factors associated with the failure of conservative treatment of right colonic diverticulitis (Fig. 1).

This study was approved by the Institutional Review Board of Uijeongbu St. Mary's Hospital (No. UC20RISI0013), National Health Insurance Service Ilsan Hospital (NHIMC 2020-01-020), and Ajou University School of Medicine (AJIRB-MED-MED-19-554) with a waiver of informed consent.

Classification of patients according to the treatment response

The conservative treatment success group included patients whose colonic diverticulitis was successfully treated with nil per os (NPO), fluid therapy with the administration of antibiotics, pain control, and percutaneous drainage of an abscess, if necessary, and who were subsequently discharged from the hospital after index administration. Initial antibiotic agents administered were intravenous (IV) cephalosporin plus metronidazole. The conservative treatment failure group included patients presenting with persistent or aggravated symptoms, for whom surgical resection was deemed necessary, despite the above-mentioned conservative care. Persistent or

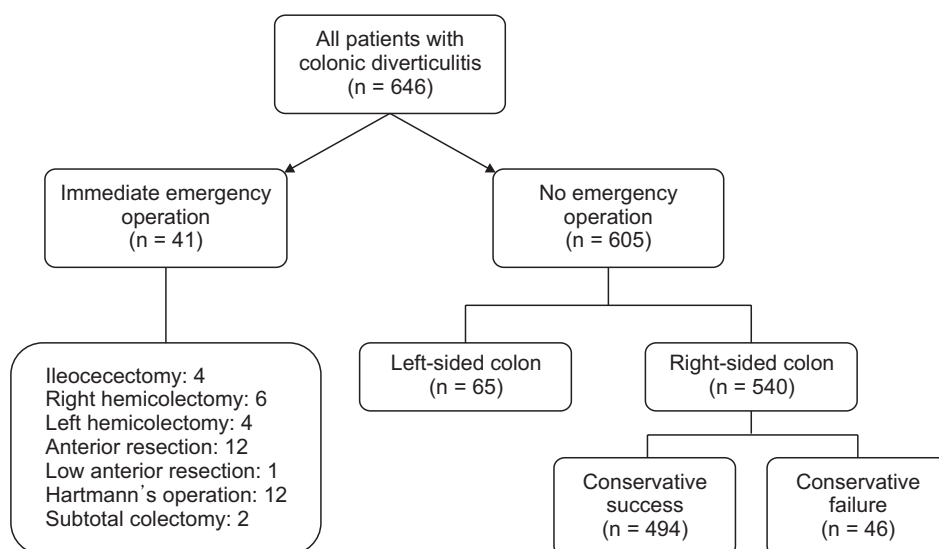


Fig. 1. Study population and management at admission.

aggravated symptoms were defined as the presence of spiking fever over 37.8°C that did not subside or occurrence of sustained abdominal pain at more than visual analogue scale (VAS) 6 during hospitalization despite using IV antibiotics and NPO. These patients could not transition from NPO to a solid diet or had to return to NPO from a liquid or solid diet owing to the recurrence of abdominal pain during admission. More than 2 colorectal surgeons decided whether conservative treatment failure or not in each of the 3 hospitals.

Modified Hinchey grades based on radiological abdominopelvic CT findings

The modified Hinchey grades (mHGs) were as follows: grade 0, mild clinical diverticulitis; grade 1a, confined pericolic inflammation or phlegmon; grade 1b, confined pericolic abscess; grade 2, pelvic, intraabdominal, or retroperitoneal abscess; grade 3, generalized purulent peritonitis; and grade 4, fecal peritonitis [8].

Clinical data for the prediction of treatment responses

Clinical data were retrospectively collected via medical records, including the age, sex, body mass index, initial body temperature, chief complaints, symptom duration, VAS score for abdominal pain at the emergency department visit, previous history of colonic diverticulitis, Charlson comorbidity index (CCI) [9], history of abdominal surgery, mHG [10], and duration of hospital stay. The laboratory data of patients were collected and analyzed, and the following inflammatory markers were evaluated: the initial WBC count; ratio of segmented neutrophils, lymphocytes, and monocytes; platelet count; albumin level; CRP level; neutrophil/lymphocyte ratio (NLR); lymphocyte/monocyte ratio (LMR); platelet/lymphocyte ratio (PLR); systemic immune-inflammation index (SII); CRP/albumin ratio; and modified Glasgow prognostic score (mGPS).

We dichotomized CCI values into CCI < 3 (mild) vs. CCI ≥ 3 (moderate to severe) [11] and mHG into 0–1a (uncomplicated) vs. into ≥1b (complicated) to conduct the chi-square test. SII was determined using the following formula: (platelet count × neutrophil count)/lymphocyte count [12]. mGPS was developed as a 3-tiered score as follows: 0, normal CRP and albumin levels; 1, elevated CRP (>1.0 mg/dL) levels; and 2, elevated CRP (>1.0 mg/dL) levels and hypoalbuminemia (<3.5 g/dL) [13].

Statistical analysis

Demographic data were compared between the 2 groups using a chi-square test or Fisher exact test for categorical variables and the Student t-test for continuous variables. The association between clinical factors and conservative treatment failure was assessed using a multiple logistic regression model, using variables that showed a P-value of <0.2 for univariate

analysis. A P-value less than 0.05 was considered statistically significant. Receiver operating characteristics (ROC) curve analysis was used for the evaluation of the area under the curve and the sensitivity and specificity as a function of the cutoff value for a prognostic marker of CRP. All statistical analyses were performed using R ver. 3.6.2 (R Foundation for Statistical Computing, Vienna, Austria) and IBM SPSS Statistics ver. 25 (IBM Corp., Armonk, NY, USA).

RESULTS

The demographic and clinical characteristics of 540 patients are summarized in Table 1. The median age of the total

Table 1. Demographic characteristics of patients with right-sided colonic diverticulitis

Variable	Data
No. of patients	540
Age (yr)	42.0 (32.0–49.0)
≤30	114 (21.1)
>31, ≤40	135 (25.0)
>41, ≤50	173 (32.0)
>51, ≤60	82 (15.5)
>61, ≤70	25 (4.6)
>71, ≤80	9 (1.7)
>80	2 (0.4)
Sex	
Male	299 (55.4)
Female	241 (44.6)
Body mass index (kg/m ²)	23.1 (21.2–25.9)
Initial body temperature (°C)	36.9 (36.6–37.3)
Chief complaint	
Abdominal pain	528 (97.8)
Fever	7 (1.3)
Nausea or vomiting	1 (0.2)
Others	5 (0.7)
Symptom duration before admission (day)	2.0 (2.0–3.0)
Initial VAS score	3.0 (2.0–3.0)
Charlson comorbidity index	
0	433 (80.2)
1	42 (7.8)
2	44 (8.1)
≥3	21 (3.9)
History of abdominal operations	113 (20.9)
Number of episodes	
One episode	461 (85.4)
Recurrent episodes	79 (14.6)
Modified Hinchey grade in imaging	
0	23 (4.3)
1a	367 (68.0)
1b	146 (27.0)
2	4 (0.7)

Values are presented as number only, median (interquartile range), or number (%). VAS, visual analogue scale.

population was 42 years, ranging from 32 to 49 years. Moreover, 78.1% of the patients were younger than 50 years of age. Among these, 55.4% of the patients (n = 299) were male and 44.6% were female (n = 241). The CCI was distributed from 0 to 9 with 80.2% of the patients scoring 0 (n = 433), of which only 3.9% of the patients had a CCI of ≥ 3 (n = 21). Most patients were classified as mHG 1a (68.0%, n = 367), and patients with mHG $\geq 1b$ were estimated to be 27.8% (n = 146) in the initial abdominopelvic computed tomography conducted at the emergency room (Table 1).

Clinical characteristics of patients in the conservative success and conservative failure groups

Patients were divided into 2 groups, namely the conservative success group (n = 494) and the conservative failure group (n = 46). The ratio of patients aged ≥ 50 years was higher in the conservative treatment failure group (20.0% [n = 99] vs. 41.3% [n = 19], P = 0.002). The ratio of sex, initial body temperature, chief complaint, duration of symptom, the ratio of CCI ≥ 3 , and initial VAS were not markedly different between the 2 groups.

The proportions of patients with mHG $\geq 1b$ were also similar between the 2 groups (28.5% [n = 141] vs. 19.6% [n = 9], P = 0.259); however, the ratio of recurrent diverticulitis was higher in the conservative treatment failure group than that in the conservative treatment success group, respectively (12.6% [n = 62] vs. 37.0% [n = 17], P < 0.001). The duration of IV antibiotic administration was significantly longer in the conservative treatment failure group (4.0 [3.0–5.0] days vs. 8.0 [6.0–12.0] days; P < 0.001). Percutaneous drainage of an abscess was not necessary for patients in either group. Furthermore, the duration of hospitalization was significantly different between these groups (4.0 [2.0–3.0] vs. 10.5 [6.0–14.0]; P < 0.001) (Table 2).

Regarding the levels of inflammatory markers, the lymphocyte count was higher in the conservative success group ($1.9 [1.5-2.5] \times 10^3/\mu\text{L}$) than that in the conservative failure group ($1.7 [1.3-2.2] \times 10^3/\mu\text{L}$) (P = 0.021), though no difference in the initial WBC count was observed (P = 0.535). CRP levels were higher in the conservative treatment failure group than those in the conservative treatment success group (3.4 mg/dL [1.3–7.1 mg/dL] vs. 5.2 mg/dL [2.0–11.0 mg/dL], respectively; P = 0.044). Although the CRP/albumin ratio was slightly but not

Table 2. Clinical characteristics of patients with right-sided colonic diverticulitis

Characteristic	Conservative treatment		P-value
	Success group	Failure group	
No. of patients	494	46	
Age (yr)			0.002
≤ 50	395 (80.0)	27 (58.7)	
> 50	99 (20.0)	19 (41.3)	
Sex			0.529
Male	271 (54.9)	28 (60.9)	
Female	223 (45.1)	18 (39.1)	
Body mass index (kg/m ²)	23.1 (21.1–25.9)	23.4 (21.5–25.6)	0.665
History of abdominal operations	101 (20.4)	12 (26.1)	0.478
Initial body temperature (°C)	36.9 (36.6–37.3)	37.0 (36.7–37.6)	0.414
Chief complaint			0.544
Abdominal pain	483 (97.8)	45 (97.8)	
Fever	7 (1.4)	0 (0.0)	
Nausea or vomiting	1 (0.2)	0 (0.0)	
Others	3 (0.6)	1 (2.2)	
Duration of symptom (day)	2.0 (2.0–3.0)	2.0 (1.0–4.0)	0.398
Initial VAS score	3.0 (2.0–3.0)	3.0 (2.0–4.0)	0.575
Number of episodes			<0.001
One episode	432 (87.4)	29 (63.0)	
Recurrent episodes	62 (12.6)	17 (37.0)	
Charlson comorbidity index, ≥ 3	19 (3.8)	2 (4.3)	>0.999
Modified Hinchey grade			0.259
0–1a	353 (71.5)	37 (73.9)	
$\geq 1b$	141 (28.5)	9 (19.6)	
Hospital stay (day)	5.4 \pm 2.5	12.5 \pm 8.1	<0.001

Values are presented as number only, number (%), median (interquartile range), or mean \pm standard deviation. VAS, visual analogue scale.

significantly higher in the conservative treatment failure group (P = 0.056) (Table 3).

Risk analyses of associated factors affecting the failure of conservative treatment of right colonic diverticulitis

Univariate analysis revealed that age (≥ 50 or >50 years), recurrent episodes of colonic diverticulitis, initial lymphocyte counts, initial CRP, NLR, SII, CRP/albumin ratio, and mGPS were markedly associated with conservative treatment failure in the right-sided colon.

We further conducted a multivariate analysis to identify risk factors. Based on the results of univariate analysis, age, recurrent attacks, mHG, initial lymphocyte and platelet counts, CRP, NLR, PLR, SII, CRP/albumin ratio, and mGPS were not found to be significantly different (P < 0.200). These factors were considered for multivariate analysis, which revealed that among the various inflammatory markers, age (odds ratio [OR], 2.54; 95% confidence interval [CI], 1.27–5.08; P = 0.008), recurrent episodes of colonic diverticulitis (OR, 4.78; 95% CI, 2.38–9.61; P < 0.001), and CRP levels (OR, 1.07; 95% CI, 1.03–1.12; P = 0.001) were independent risk factors associated with conservative treatment failure. Furthermore, mHG was not significantly associated with the outcome of conservative treatment (P = 0.168) (Table 4). In the ROC analysis, the ROC area under the curve was 0.59. An optimized cutoff value of CRP was evaluated as 10.9 based on the ROC analysis (a sensitivity of 30.4% and a specificity of 89.3%) (Fig. 2).

DISCUSSION

In this study, we compared outcomes between the conservative treatment success and the conservative treatment failure groups and investigated predictive factors responsible for conservative management failure for right colonic diverticulitis. Consequently, multivariate analysis revealed that age of >50 years, recurrent episodes of colonic diverticulitis, and CRP levels were independent predictive factors for conservative treatment failure. Inflammatory markers including NLR, LMR, PLR, and SII, which were better predictors determined on the basis of the naïve complete blood count in patients diagnosed with cancer or other acute diseases [14,15], were not of predictive value in this study. Instead, the CRP level was interestingly the most potent and the only independent predictive factor responsible for conservative treatment failure among the inflammatory markers.

Although treatment decision for colonic diverticulitis has been largely based on the Hinchey classification [3], in numerous cases, the patients' symptoms are incongruent with the Hinchey classification or failure in management via analysis based on the Hinchey classification. Furthermore, conservatively managed patients generally experience repeated symptoms, aggravated complications, and reduced quality of life. Some studies have reported that colonic resection should be considered for recurrent diverticulitis, even though patients do not present with complicated symptoms including panperitonitis. Worse outcomes were observed during long-term

Table 3. Inflammatory markers in patients with right-sided colonic diverticulitis

Inflammatory marker	Conservative treatment		P-value
	Success group (n = 494)	Failure group (n = 46)	
WBC count ($\times 10^3/\mu\text{L}$)	11.1 (8.9–13.3)	11.1 (8.9–12.8)	0.535
Segmented neutrophils ($\times 10^3/\mu\text{L}$)	8.1 (6.0–9.9)	7.8 (5.6–10.1)	0.793
Lymphocytes ($\times 10^3/\mu\text{L}$)	1.9 (1.5–2.5)	1.7 (1.3–2.2)	0.021
Monocytes ($\times 10^3/\mu\text{L}$)	0.8 (0.6–1.0)	0.7 (0.6–0.9)	0.281
Platelet count ($\times 10^3/\mu\text{L}$)	247.5 (212.0–282.0)	225.5 (180.0–280.0)	0.066
Albumin (g/dL)	4.4 (2.8–5.4)	4.5 (4.2–4.6)	0.897
CRP (mg/dL)	3.4 (1.3–7.1)	5.2 (2.0–11.1)	0.044
NLR	4.0 (2.8–5.4)	4.4 (2.6–7.1)	0.158
LMR	2.5 (1.8–3.4)	2.6 (1.5–3.4)	0.428
PLR	124.8 (99.3–160.2)	127.8 (94.4–189.9)	0.442
SII ($\times 10^3/\mu\text{L}$)	950.0 (649.0–1,361.0)	934.0 (589.0–1,826.0)	0.546
CRP/albumin ratio	0.7 (0.3–1.7)	1.3 (0.4–2.4)	0.056
mGPS			0.021
0	435 (88.1)	34 (73.9)	
1	58 (11.7)	12 (26.1)	
2	1 (0.2)	0 (0)	

Values are presented as median (interquartile range) or number (%).

NLR, neutrophil/lymphocyte ratio; LMR, lymphocyte/monocyte ratio; PLR, platelet/lymphocyte ratio; SII, systemic immune-inflammation index; mGPS, modified Glasgow prognostic score.

Table 4. Univariate and multivariate analyses for risk factors of conservative care failure in patients with right-sided colonic diverticulitis

Variable	Univariate analysis		Multivariate analysis	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Age, >50 yr	4.21 (1.84–9.60)	<0.001	2.54 (1.27–5.08)	0.008
Male sex	0.78 (0.42–1.45)	0.434		
Body mass index, ≥ 23 kg/m ²	1.01 (0.94–1.08)	0.825		
Recurrent attack, yes	4.08 (2.12–7.86)	<0.001	4.78 (2.38–9.61)	<0.001
mHG, $\geq 1b$	0.61 (0.29–1.29)	0.197	0.56 (0.25–1.26)	0.159
WBC count	0.97 (0.89–1.06)	0.486		
Neutrophil count	0.99 (0.91–1.09)	0.874		
Lymphocyte count	0.54 (0.34–0.87)	0.012		
Monocyte count	0.55 (0.21–1.45)	0.228		
Platelet count	1.00 (0.99–1.00)	0.153		
Albumin	1.12 (0.49–2.53)	0.789		
CRP	1.09 (1.04–1.13)	<0.001	1.08 (1.03–1.12)	0.001
NLR	1.08 (1.01–1.16)	0.023		
LMR	0.90 (0.71–1.13)	0.365		
PLR	1.00 (1.00–1.01)	0.087	1.00 (1.00–1.01)	0.168
SII	1.00 (1.00–1.00)	0.025		
CRP/albumin ratio	1.40 (1.19–1.65)	<0.001		
mGPS	2.45 (1.23–4.90)	0.011		

OR, odds ratio; CI, confidence interval; mHG, modified Hinchey grade; NLR, neutrophil/lymphocyte ratio; PLR, platelet/lymphocyte ratio; SII, systemic immune-inflammation index; mGPS, modified Glasgow prognostic score.

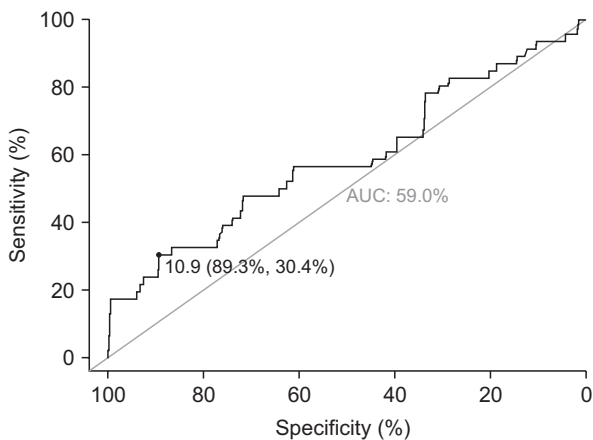


Fig. 2. Receiver operating characteristics (ROC) curves for cutoff value of CRP to determine the failure of conservative management for right colonic diverticulitis. On the x axis, false-positive/1-specificity, and on the y axis, true positive/sensitivity are expressed. AUC, area under the ROC curve.

follow-up of patients undergoing conservative management in the first episode [6,7], and a substantial burden was posed on patients because of increased hospital expenses [1,6]. The failure rates of conservative management vary among studies, and up to 67% of the patient fail and experience relapse with persistent disease [6,16]. Advancements in surgical approaches recommend a personalized decision-making process for each patient [17]. Hinchey classification is limited by factors, such as the precise

junction at which operation should be conducted or the determination of patients who should be subjected to surgical treatment, for individualized treatment of acute diverticulitis. In this study, the difference in the severity of diverticulitis, based on the Hinchey classification, was not significant between the groups. Based on the results of multivariate analysis, the Hinchey classification was not a predictive factor for conservative treatment failure. These results indicate the necessity of obtaining objective evidence beyond conduction of the analysis based on the Hinchey classification. Therefore, further studies are warranted to identify objective markers or criteria to achieve tailored treatment of colonic diverticulitis. We focused on right-sided colonic diverticulitis because most such cases have been generally managed through conservative treatment rather than through surgical treatment.

Young age has been considered as a significant risk factor for recurrence, and elective resection for patients younger than 50 years of age is advised [18]. Although the prevalence of diverticulitis markedly increases with age, young patients are considered to present with worse clinical outcomes [19]. However, more recent studies have reported similar severity of this disease in younger and older patients and suggested that young age is not a risk factor. Hupfeld et al. [20] did not observe any increased association between young age and the development of recurrent diverticulitis in any of the 20 studies considered in their meta-analysis. Previous studies on whether the age of <50 years is a significant risk factor have

reported findings related to the development of sigmoid colon diverticulitis. In contrast with previous studies, our study focused on right colonic diverticulitis and reported significant differences in the ratio of patients aged >50 years in the conservative failure rather than the conservative success group. Furthermore, this served as a prognostic factor for conservative management failure in right colonic diverticulitis. The association between age and recurrence remains controversial. Since no clear guidelines have been established for right colonic diverticulitis, additional large-scale studies are necessary to confirm these findings.

As diverticulitis is not a progressive disease, recent studies suggest that patients with a recurrence of more than 2 episodes are not at an increased risk of morbidity and mortality compared to those presenting with fewer episodes [21]. However, 1 meta-analysis reported that the recurrence risk was proportional to the number of recurrences [20]. A large cohort study involving 118,115 patients reported similar results, with recurrence rates of 8.7% upon initial admission, 23.2% upon the 2nd admission, 35.8% upon the 3rd admission, 41.1% upon the 4th admission, and 45.6% upon the 5th admission [22]. In this study, the recurrence ratio was significantly different in the conservative failure group, thereby serving as a significant risk factor for conservative treatment failure (OR, 4.78; 95% CI, 2.38–9.61; $P < 0.001$). These findings indicate that the frequency of patients' symptoms and quality of life should be considered after the initial attack along with complications resulting from recurrent episodes [23,24]. In our study, 78.5% ($n = 62$) of the patients with recurrent attacks (more than 2) were observed in the conservative management success group, which was slightly higher than that reported in a previous study [18]. We only included patients with right colonic diverticulitis. Right colonic diverticulitis presents with fewer abscess or perforation events when compared to left colonic diverticulitis. Thus, the rate of patients in the conservative management success group, in spite of recurrent attacks, may be higher than that reported in other studies. Second, we included patients in the conservative failure group who were advised to undergo operation with conservative management failure. However, some patients were decided to undergo elective surgical treatment in an outpatient clinic owing to recurrent attacks although their symptoms did not worsen or exhibit severity. We classified these patients in the conservative success group; hence, this study shows higher rates of patients with recurrent attacks in the conservative management group.

We examined various inflammatory markers, such as the NLR, LMR, PLR, SII, WBC count, CRP level, CRP/albumin ratio, and mGPS to evaluate predictive factors for the success or failure of conservative management of acute right colonic diverticulitis. Tests for inflammatory markers are inexpensive, and the ratios can easily be determined from differential WBC

counts to predict the severity of inflammation. Mari et al. [25] investigated whether NLR and PLR were associated with the development of complicated diverticulitis and investigated the correlation between the severity of diverticulitis and the Hinchey classification. Although the authors reported correlations between NLR and PLR and the severity of diverticulitis or Hinchey classification, the correlations were considered additional parameters for Hinchey classification to optimize the management of diverticulitis.

Few studies evaluating prognostic factors for conduction of radiological or surgical intervention have highlighted the role of inflammatory markers; however, colonic diverticulitis was examined regardless of the location [26,27]. We investigated the predictive value of various inflammatory markers, focusing on patients with right colonic diverticulitis. In this study, we could not assess the diagnostic or predictive value of inflammatory markers including NLR, LMR, PLR, SII, CRP/albumin ratio, and mGPS. However, CRP levels were significantly higher in the conservative treatment failure group than those in the conservative treatment success group. Multivariate analysis revealed that CRP levels helped predict conservative treatment failure among patients with right-sided colonic diverticulitis. Several studies have reported the association between CRP levels and the risk of developing acute diverticulitis and have revealed similar outcomes with the present results; however, they did not include investigation of other inflammatory markers [28,29]. Meanwhile CRP was shown as prognostic marker in the multivariate analysis, the cutoff value of CRP derived from ROC curve had low sensitivity and high specificity. Therefore, we should pay close attention when using the cutoff value as a reference point for clinical practice. Although we suggested the cutoff value of CRP with 10.9, we need more studies with a large number of patients to verify the accuracy of it.

This study has a few limitations. This is a retrospective study; hence, a selection bias may exist. We retrospectively assessed which patients failed with conservative management and should have been subjected to surgical treatment. There was a marked difference in the number of individuals between the 2 groups because of the retrospective design of the study. We compared the outcomes in a small number of patients because conservative management continues to be preferred after patients present with recurrent episodes.

In conclusion, modified Hinchey classification is not a predictive factor to ascertain the success or failure of conservative management in patients with right colonic diverticulitis. Old age (>50 years), recurrent episodes, and CRP levels were significantly associated with the failure of conservative management. Therefore, clinical information, such as subjective symptoms or frequency of episodes, remains important to determine the treatment strategy, and high

initial CRP levels may help ascertain the need for conducting early surgical intervention. Further studies are required to establish appropriate criteria for selection of patients requiring conservative or surgical management for right colonic diverticulitis in a large-scale study.

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Conflict of Interest

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

ORCID iD

Youn Young Park: <https://orcid.org/0000-0001-7724-1492>

Soomin Nam: <https://orcid.org/0000-0002-7537-8329>

Jeong Hee Han: <https://orcid.org/0000-0001-6593-3440>

Jaeim Lee: <https://orcid.org/0000-0002-4074-3904>

Chinock Cheong: <https://orcid.org/0000-0002-7723-0053>

Author Contribution

Conceptualization: JHH, CC

Formal Analysis: JL

Investigation: CC, YYP, SN

Methodology: JHH, JL

Project Administration: CC

Writing – Original Draft: YYP, SN, JL

Writing – Review & Editing: JHH, CC

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