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ORIGINAL ARTICLE

Prospective randomized clinical trial of uncomplicated right-sided colonic diverticulitis: antibiotics versus no antibiotics

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Abstract

Purpose Antibiotics are widely used in the treatment of uncomplicated left-sided colonic diverticulitis. In Asian countries, however, right-sided colonic diverticulitis is more common than left-sided colonic diverticulitis. The aim of the present study was to evaluate the need for antibiotics in the treatment of uncomplicated right-sided colonic diverticulitis in an Asian population.

Methods Patients were randomized to two management strategies: antibiotics and no antibiotics. At 4–6 weeks after discharge, the patients in both groups underwent computed tomography or were contacted by phone to confirm the effectiveness of the treatment. The primary end point was the treatment failure rate of the initial treatment, and secondary end points were the length of hospital stay and total admission costs.

Results Patients were randomized to treatment with (61 patients) or without (64 patients) antibiotics. The rates of treatment failure in the antibiotics and no antibiotics groups were 1.7% and 4.6%, respectively, with no significant difference ($P = 0.619$). There was also no significant difference in the length of hospital stay between the groups ($P = 0.983$). Total admission costs were lower in the no antibiotics group than in the antibiotics group (US$1004.70 vs US$1112.40, respectively, $P = 0.037$).

Conclusion Conservative management of uncomplicated right-sided colonic diverticulitis without antibiotics shows similar treatment failure rates and length of hospital stay, and is associated with lower hospital costs, compared with standard antibiotic treatment. Therefore, conservative management can be considered as a safe treatment option.

Trial registration ClinicalTrial.gov No. NCT02314013

Keywords Right-sided colonic diverticulitis · Antibiotics · Conservative management

Introduction

The prevalence of diverticular disease of the colon is showing an increasing trend worldwide [1–3]. The treatment of uncomplicated diverticulitis most commonly includes hospital admission, bowel rest, hydration, and broad-spectrum antibiotics [4, 5]. Various guidelines have been published in the USA and Europe [6–8]; however, the treatment of uncomplicated acute diverticulitis has not been standardized [9, 10].

The rationale for treatment with broad-spectrum antibiotics is based on the understanding that diverticulitis results from colonic microperforation, and that antibiotics prevent subsequent free perforation and abscess formation [11, 12]. However, overuse of antibiotics is associated with an increase in antibiotic-resistant bacteria and the side effects of antibiotic use include fever, diarrhea, and allergic reaction [13–15]. Recent studies have suggested that diverticulitis could be a form of inflammatory bowel disease rather than the result of microperforation [16, 17]. Furthermore, two randomized clinical trials showed that conservative treatment without antibiotics did not delay recovery time or increase the rates of complication and recurrence [18, 19]. It is noteworthy that in Western populations, the majority of diverticulitis is left-sided, whereas the majority is right-sided in Asian populations [1, 20–23]. Right-sided colonic diverticulitis is associated with lower complication rates and a lower incidence of complicated diverticulitis compared with left-sided colonic diverticulitis [24–26]. Recent guidelines for the treatment of diverticulitis focus on left-sided colonic diverticulitis [6–8]. In contrast, there is little information regarding the diagnosis and

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treatment of right-sided colonic diverticular diseases, and no treatment guidelines have been established.

To the best of our knowledge, there are no published randomized clinical trials of conservative treatment without antibiotics for uncomplicated right-sided colonic diverticulitis. Therefore, the aim of the present study was to evaluate the influence of antibiotics on the treatment failure rate, length of hospital stay, and total hospital costs in patients with uncomplicated right-sided diverticulitis.

Methods

This study was a single-center, open-label, randomized controlled trial of patients with uncomplicated right-sided diverticulitis who were treated at Dongtan Sacred Heart Hospital between April 2014 and March 2018. The study was approved by the Institutional Review Board (IRB-2014-023) and followed the Declaration of Helsinki guidelines. This trial is registered with ClinicalTrial.gov (NCT02314013).

The grade of diverticulitis was classified according to the modified Hinchey Classification [27]. Specifically, uncomplicated diverticulitis is defined as grade Ia and complicated diverticulitis includes grades Ib, II, III, and IV. Inclusion criteria for the study were: (1) age 18–80 years; (2) right-sided colonic diverticulitis (cecum, ascending colon, or proximal transverse colon); and (3) uncomplicated diverticulitis (grade Ia) [27]. Exclusion criteria were: (1) age < 18 or > 80 years; (2) distal transverse, left-sided, or sigmoid colonic diverticulitis; (3) complicated colonic diverticulitis (grades Ib, II, III, or IV); (4) sepsis; (5) systemic inflammatory response syndrome (SIRS); (6) immunocompromised patients (taking corticosteroid or immunosuppressive drugs, transplantation, or chronic renal failure with hemodialysis); (7) allergy to quinolone antibiotics; (8) pregnant or lactating patients; (9) American Society of Anesthesiologists (ASA) score > 3; (10) social, psychiatric, or cognitive impairment; and (11) patient refusal for involvement in the trial.

Study design

In patients suspected clinically to have diverticulitis, intravenous (IV) contrast–enhanced computed tomography (CT) was performed to confirm the diagnosis and to exclude other diseases. The CT images were reviewed and evaluated by two experienced radiologists (Professors SJ Min and YC Kim). Potential participants listened to the proposed study design with respect to their diagnosis and were then required to sign an informed consent document before randomization. Eligible patients were then randomly assigned 1:1 to the antibiotics group or no antibiotics group using a computer-generated list with a random permuted block design. Patients were allocated by means of sealed sequenced (masked) envelopes. Clinicians, the data manager, and patients were masked to treatment assignment. After randomization, patients were allocated to one of the following treatment groups: bowel rest and IV fluids (no antibiotics group) or bowel rest, IV fluids, and antibiotics (antibiotics group). After allocation to the treatment groups, we evaluated the progression of diverticulitis according to the white blood cell (WBC) counts on the first, second, and third (or fourth or fifth) days, as well as on discharge day. Body temperature was measured on admission day, three times a day during the hospital stay, and on discharge day. The body temperatures in Fig. 2 show the mean temperature value for the date, except on admission and discharge day. We also checked the patients' degree of pain daily using a patient reporting pain scale (PRePS), which defines the initial pain score at admission as 10 and no pain as 0, and post-admission aggravation of pain as a score of 11+.

Patients in the no antibiotics group were admitted, administered IV fluids, and given bowel rest for at least 3 days (and up to 5 days) until the clinical signs and symptoms stabilized. When there was no further increase in WBC count, body temperature, or PRePS score, the patients were allowed sips of water and then a soft diet until discharge. If a patient in this group deteriorated clinically (elevated WBC count, body temperature, or PRePS score, we considered starting antibiotic treatment or emergent surgery.

Patients in the antibiotics group were admitted, given bowel rest, and started on the same diet sequence as those in the no antibiotics group. Intravenous antibiotics were initiated with a combination of a third-generation cephalosporin (ceftriaxone, 2 g IV, once daily) and metronidazole (500 mg IV, three times daily). After oral intake was tolerated, oral antibiotics were initiated, such as cefpodoxime (100 mg, two times daily), together with metronidazole (250 mg, three times daily). Patients allergic to penicillin were prescribed ciprofloxacin (200 mg IV, two times daily) combined with metronidazole (500 mg IV, three times daily), with an oral dose of ciprofloxacin (250 mg, two times daily) and metronidazole (250 mg, three times daily). The total duration of antibiotic treatment was 10 days. If a patient in this group deteriorated clinically, we considered emergent surgery. The 10-day duration of antibiotic treatment was maintained in patients with early improvement before the 10th day of antibiotic use. If a patient's symptoms were aggravated or the patient did not improve despite the 10-day antibiotic treatment, he or she was re-admitted through the outpatient clinic or emergency room; this was regarded as treatment failure. The patient then underwent surgery, radiologic intervention, or antibiotic treatment, depending on the patient's clinical condition. Clinically stable patients, as indicated by a decrease in WBC count or PRePS, the absence of fever, and who tolerated oral intake, were eligible for discharge.

Follow-up

All patients were followed-up in the outpatient clinic until day 14 after discharge. Each patient's clinical status was assessed, including the absence of abdominal pain and fever, and the resumption of a regular diet. At 4–6 weeks after discharge, patients in both groups underwent a follow-up CT or colonoscopy to confirm the presence of diverticular disease and to exclude an underlying malignancy. If a patient was unable to visit the outpatient clinic, we assessed their condition by telephone. In addition, after patient enrollment was completed, we retrospectively reviewed the medical records until March 2018, and recorded data for the recurrence of diverticulitis, treatment approach (including antibiotics), and incidence of surgery.

Primary and secondary end points

Treatment failure was defined as a persistence of, or increase in, abdominal pain and/or fever and/or WBC count, readmission after discharge within 6 weeks, the need for percutaneous drainage of an abscess, or emergent surgery. Sepsis or SIRS occurring within 6 weeks after discharge was regarded as treatment failure. For patients in the no antibiotics group, treatment failure also included the initiation of antibiotic treatment. The primary end point was the treatment failure rate of patients in the no antibiotics group compared with that of patients in the antibiotics group. The secondary end points were the evaluation of total admission costs and the length of hospital stay. We calculated the total admission cost for the first episode under the fee for our service reimbursement system. The total admission cost was analyzed in detail, and included the costs of consultation, room, medications, examinations, diagnosis, and diet. Medical costs were based on the official prices in Korean won (KRW) and were converted to US dollars (USD). One USD corresponded to 1055.1 KRW based on the purchasing power parities of the International Comparison Program (ICP) of the World Bank.

Recurrence of diverticulitis was defined as presentation with identical symptoms and radiologic findings as those of the initial diverticulitis at least 6 weeks after discharge.

Statistical analysis

All patients were analyzed on an intention-to-treat principle. The sample size was calculated from previous results, as follows. The failure rate of antibiotic treatment for uncomplicated diverticulitis was 6.1% in a randomized clinical trial [28], and was 4% for patients in a no antibiotics group [29]. Therefore, the expected that the treatment failure rate was 5%. Allowing a difference of 10% as the non-inferiority limit, 5% of type 1 error, 80% power, and a 10% anticipated dropout rate, a total of 66 patients were required for each group.

All analyses were performed using SPSS version 24.0 (SPSS, Chicago, IL, USA). Continuous variables are presented as the mean and standard deviation, and were compared using Student's *t* tests or the Mann–Whitney *U* test as appropriate. Categorical variables are presented as the number and percent of patients, and were analyzed using the χ^2 test or Fisher's exact test as appropriate.

A Cox proportional hazards regression model was performed to assess the risk factors of recurrence. Confounding factors selected for the Cox regression included factors that were previously reported to have an association with recurrence [30–32]. The continuous variables were categorized according to mean values for age, WBC count, C-reactive protein (CRP), and the size of diverticulum; and the value of definition for fever (> 37.8 °C) and obesity (body mass index [BMI] > 25). A P value < 0.05 was considered statistically significant.

Results

One hundred and fifty patients were screened for eligibility, of whom 132 were randomly assigned to either the antibiotics group ($n = 66$) or no antibiotics group ($n = 66$) (Fig. 1). One patient in the no antibiotics group and two patients in the antibiotics group were excluded because of protocol violation. One patient in the antibiotics group refused to participate in the study after randomization. Follow-up loss occurred in one patient in the no antibiotics group and two patients in the antibiotics group. Finally, 64 patients in the no antibiotics group and 61 patients in the antibiotics group were enrolled in the study.

Patient characteristics, according to the treatment method, are listed in Table 1. The mean ages of patients in the no antibiotics and antibiotics groups were 38.9 and 37.9 years, respectively ($P = 0.514$). The two groups were comparable with respect to BMI, comorbidity, CRP, WBC count, and body temperature.

Table 2 shows the clinical outcomes with and without antibiotic treatment. Recovery times, including the time to sips of water ($P = 0.302$), time to soft food intake ($P = 0.122$), and the length of hospital stay ($P = 0.985$) were similar in both groups. The total admission cost was US$108.4 less in the no antibiotics group (no antibiotics group vs antibiotics group: US$1004.7 vs US$1112.4, $P = 0.037$). There were no differences between the two groups in terms of the consultation, room, examination, diagnosis, and diet costs, whereas medication costs were lower in the no antibiotics group (US$148.5 vs US$259.5, $P < 0.001$). In the 4–6-week follow-up period after discharge, CT scans were performed in 42 patients in the no antibiotics group and 41 patients in the antibiotics group ($P = 0.891$) and colonoscopy was performed in 4 and 8 patients, respectively ($P = 0.234$). Thirty patients received a phone call (18 vs 12 patients, $P = 0.372$).

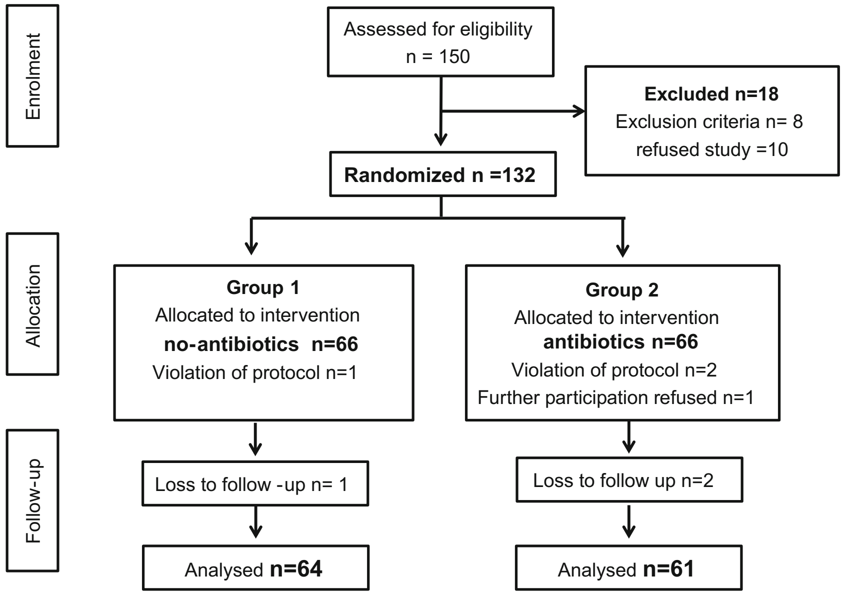

Fig. 1 Flow chart for the trial. One hundred and fifty patients were screened for eligibility, of whom 132 were randomly assigned to either the antibiotics group ($n = 66$) or the no antibiotics group ($n = 66$) (Fig. 1). Eighteen patients were excluded for the following reasons: exclusion criteria (eight patients) and refusal to participate (ten patients). One patient in the no antibiotics group and two patients in the antibiotics group were excluded because of protocol violation. One patient in the antibiotics group refused to participate in the study after randomization. Follow-up loss occurred in one patient in the no antibiotics group and two patients in the antibiotics group. Finally, 64 patients in the no antibiotics group and 61 patients in the antibiotics group were enrolled in the study

There was no difference in treatment failure between the two groups ($P = 0.619$): three patients (4.7%) in the no antibiotics group and one patient (1.6%) in the antibiotics group experienced treatment failure. Specifically, two patients in the no antibiotics group were started on antibiotics because of increased PRePSs and WBC counts, and the remaining patient was re-admitted due to recurrence of diverticulitis 4 weeks after discharge. One patient in the antibiotics group was re-admitted 5 weeks after discharge due to recurrence of diverticulitis, and underwent surgery. Despite the small sample size in the present study, there were no reported side-effects of antibiotic treatment, including allergic reaction, and there was no mortality.

Table 1 Patient demographics and clinical manifestation according to type of management

	No-antibiotics ($n = 64$)	Antibiotics ($n = 61$)	*P*
Age (years)	38.9 (9.5)	37.9 (8.4)	0.514
Male	37 (57.8)	40 (65.6)	0.372
BMI (kg/m^2)	24.0 (4.0)	24.2 (3.7)	0.784
Comorbidity	15 (23.4)	21 (34.4)	0.175
CRP (mg/L)	42.3 (38.5)	43.8 (49.0)	0.841
WBC (× 10^3/uL)	11.4 (2.6)	10.9 (3.7)	0.335
Body temperature (°C)	37.0 (0.5)	37.0 (0.6)	0.423

Data are presented as the number of patients (%) or mean (standard deviation) unless otherwise stated

BMI body mass index, *CRP* C-reactive protein, *WBC* white blood cell count

Table 2 Clinical outcome according to type of initial management

	No-antibiotics ($n = 64$)	Antibiotics ($n = 61$)	*P*
Time to sips of water (days)	4.1 (0.8)	3.9 (0.6)	0.302
Time to soft diet (days)	4.8 (0.9)	4.5 (1.4)	0.122
Length of hospital stay (days)	5.3 (0.8)	5.3 (0.8)	0.985
Total admission cost[a] ($)	1004.7 (285.5)	1112.4 (284.8)	0.037
Consultation	76.1 (27.5)	70.4 (27.4)	0.231
Room	294.1 (96.8)	288.3 (82.3)	0.720
Medication	148.5 (68.2)	259.5 (12.2)	< 0.001
Examination	134.7 (54.4)	129.4 (48.8)	0.567
Diagnosis	211.4 (57.1)	201.3 (74.8)	0.398
Diet	7.9 (5.6)	8.5 (6.3)	0.519
Others	2.0 (1.5)	1.6 (1.5)	0.208
Follow-up study			
CT	42 (65.6)	41 (67.2)	0.891
Colonoscopy	4 (6.3)	8 (13.1)	0.234
Telephone	18 (28.1)	12 (19.7)	0.372
Treatment failure	3 (4.7)	1 (1.6)	0.619
Recurrence	5 (7.8)	6 (9.8)	0.690

Data are presented as the number of patients (%) or mean (standard deviation) unless otherwise stated

[a] All costs are in USD (March 2018, 1055.1 KRW = 1$)

We monitored body temperature, WBC count, and PRePS in both groups during the hospital stay. There were no difference in body temperature between the groups during admission (37.0 °C for both groups, $P = 0.423$) (Fig. 2). The body temperature in both groups decreased 36.6 °C and 36.5 °C, on the day of discharge, respectively ($P = 0.198$). The WBC counts for the no antibiotics group and the antibiotics group were 11,400/μL and 10,900/μL, respectively ($P = 0.335$) on day 1 of admission, and normalized to 5800/μL and 5200/μL, respectively, on the day of discharge ($P = 0.134$) (Fig. 3). The PRePS score was 10 for both groups on day 1 of admission, decreased gradually by half (6.5 in the no antibiotics group vs 5.3 in the antibiotics group, $P = 0.010$) at day 2, and then to near zero on the day of discharge (0.4 vs 0.3, respectively, $P = 0.344$) (Fig. 4).

In our retrospective analysis, the mean duration of follow-up was 14.7 and 13.5 months in the no antibiotics and antibiotics groups, respectively. During the follow-up periods, disease recurrence occurred in similar numbers of patients in both groups (7.8% vs 9.8%, respectively, $P = 0.690$). Of the five patients in the no antibiotics group who had recurrence, four were prescribed antibiotics in the outpatient clinic, and the fifth was re-admitted and underwent conservative treatment with antibiotics. Of the six patients in the antibiotics group who had recurrence, four were prescribed antibiotics in the outpatient clinic and the remaining two were re-admitted and underwent conservative treatment with antibiotics. During the follow-up periods, no patient had severe inflammation that required emergent surgery.

The Cox regression analysis showed no influence of antibiotic use on recurrence (odds ratio [OR], 1.118; 95% confidence interval [CI], 0.297–4.208, $P = 0.869$). Age, male gender, size of diverticulum > 12 mm, multiple diverticula, severity of inflammation according to CRP (> 40 mg/L), and WBC count (> 11,000/Ul) on admission did not influence recurrence, whereas body temperature > 37.8 °C did have an effect (OR, 11.233; 95% CI, 1.291–97.710, $P = 0.028$) (Table 3).

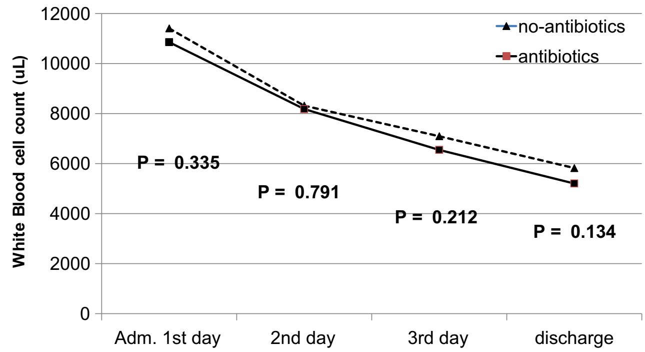

Fig. 3 White blood cell count (uL). The WBC counts for the no antibiotics group and the antibiotics group were 11,400/μL and 10,900/μL, respectively ($P = 0.335$) on day 1 of admission, and normalized to 5800/μL and 5200/μL, respectively, on the day of discharge ($P = 0.134$)

Discussion

The incidence of colonic diverticulitis is increasing in Asian and Western populations [1–3]. In contrast to Caucasian populations, right-sided colonic diverticulitis is more common than left-sided colonic diverticulitis in Asian populations, in which right-sided colonic diverticulitis has been reported in 52–82% of all cases of diverticulitis [21–25]. Although the conservative management of uncomplicated diverticulitis generally consists of hospital admission, restriction of oral intake, IV fluids, and antibiotics, there is no evidence to support this approach as best practice.

Several studies have reported the proposal of oral antibiotic treatment in an outpatient setting, which is feasible for mild grades of diverticulitis [33]. A recent randomized clinical trial (DIVER trial) for uncomplicated left-sided colonic diverticulitis revealed a similar treatment failure rate between an outpatient group and a hospitalization group (4.5% vs 6.1%, respectively, $P = 0.619$) [28]. Accordingly, outpatient treatment was considered safe and effective, with the additional benefit of saving €1124.70 [28]. In addition, Park et al. reported the effectiveness of oral antibiotic therapy for uncomplicated

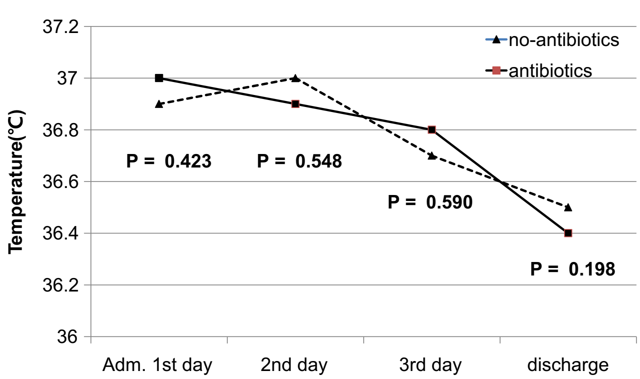

Fig. 2 Body temperature (°C). There were no difference in body temperature between the groups during admission (37.0 °C for both groups, $P = 0.423$). The body temperature in both groups decreased 36.6 °C and 36.5 °C, on the day of discharge, respectively ($P = 0.198$)

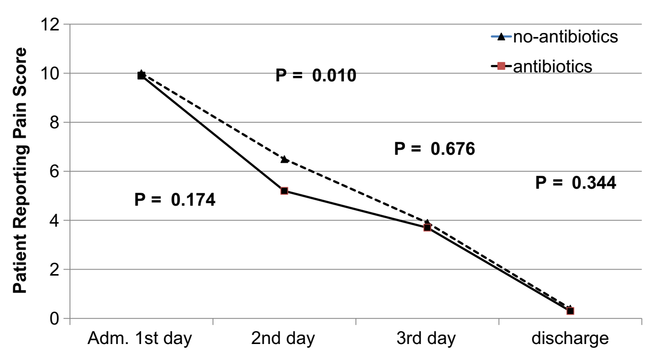

Fig. 4 Patient Reporting Pain Scale (PRePS). The PRePS score was 10 for both groups on day 1 of admission, decreased gradually by half (6.5 in the no antibiotics group vs 5.3 in the antibiotics group, $P = 0.010$) at day 2, and then to near zero on the day of discharge (0.4 vs 0.3, respectively, $P = 0.344$)

Table 3 Predictive factor of recurrence

Variable	Univariate analysis		Multivariate analysis	
	OR (95% CI)	*P*	OR (95% CI)	*P*
Age > 40 years	1.333 (0.385–4.619)	0.649	1.035 (0.239–4.475)	0.963
Male	1.100 (0.304–3.976)	0.884	0.982 (0.215–4.484)	0.981
BMI > 25	0.944 (0.261–3.412)	1.000	1.118 (0.245–5.094)	0.885
BT > 37.8 °C	1.467 (0.289–7.453)	0.645	11.233 (1.291–97.710)	0.028
WBC count > 1.1 × 10^3/Ul	1.159 (0.335–4.013)	0.816	1.093 (0.290–4.124)	0.895
CRP > 40 (mg/L)	0.597 (0.150–2.370)	0.459	0.522 (0.108–2.535)	0.420
Size of diverticulum > 12 mm	1.468 (0.407–5.293)	0.753	1.558 (0.389–6.235)	0.531
Multiple diverticulum	2.340 (0.482–11.364)	0.338	2.089 (0.392–11.141)	0.388
Calcification of diverticulum	1.667 (0.478–5.812)	0.419	1.427 (0.373–5.450)	0.603
Antibiotics	0.777 (0.224–2.691)	0.690	1.118 (0.297–4.208)	0.869

OR odd ratio, *BMI* body mass index, *BT* body temperature, *WBC* white blood cell, *CRP* c-reactive protein

right-sided colonic diverticulitis in a prospective observation study, showing a similar recurrence rate for inpatients between oral and IV antibiotics (10% vs 11%, respectively, *P* = 0.808) with a median follow-up period of 21 months [31].

Since initial evidence suggesting the etiology of diverticular diseases as a form of inflammatory bowel disease [16, 17], there have been several retrospective studies of conservative management without antibiotics for uncomplicated left-sided diverticulitis [29, 34, 35]. Furthermore, in recent years, several randomized multicenter clinical trials have also reported the results of management without antibiotics. A Swedish randomized controlled trial (AVOD) compared observational versus antibiotic treatments in patients with uncomplicated acute diverticulitis and showed similar complication rates (1.9% vs 1.0%, *P* = 0.302) and rates of recurrence (16.2% vs 15.8%, *P* = 0.881) between the two groups at 12 months of follow-up [18]. Another randomized clinical trial (DIABOLO trial) also reported that observational treatment without antibiotics did not prolong recovery time compared with antibiotic treatment (14 days vs 12 days, *P* = 0.151) and did not increase the rate of re-admission (17.6% vs 12.0%, *P* = 0.148), adverse events (48.5% vs 54.5%, *P* = 0.221), complicated diverticulitis (3.8% vs 2.6%, *P* = 0.494), or recurrent diverticulitis (3.4 vs 3.0%, *P* = 0.494) [19]. These previous randomized trials had only short-term follow-up results; however, the long-term effects of conservative management without antibiotics were published in 2018 [36]. Although the rates of sigmoid resection tended to increase in the observational groups compared with the antibiotic groups (9.0% vs 5.0%, *P* = 0.085), there were no differences in terms of the rates of complicated diverticulitis (4.8% vs 3.3%, *P* = 0.403) or recurrent diverticulitis (15.4% vs, 14.9%, *P* = 0.885) [36].

Overall, treatment failure rates in patients receiving no antibiotics range from 3.2 to 4% [18, 29, 34, 35]. In the present study of right-sided diverticulitis, treatment failure occurred in three patients (4.7%) in the no antibiotic group, which is consistent with the results of previous studies. It should be noted that the treatment failure rate usually refers to short-term results and the time limit for treatment failure varies among studies, e.g., during initial admission or within 1 month after discharge.

Disease recurrence after conservative treatment of diverticulitis is a major concern in clinical practice. The recurrence rates for right-sided and left-sided diverticulitis are similar, ranging from 8.4 to 20.5%, although they vary depending on the length of the follow-up period [31, 37–39]. It has been reported that in patients with recurrent acute uncomplicated right-sided colonic diverticulitis, medical treatment can be successful, without development of severe complications, regardless of the number of recurrences [37–39]. In the present study (follow-up period, 14.6 months), 11 patients (8.8%) had recurrence, and these were successfully treated with conservative management. Previous studies have reported the predictive risk factors for recurrence as multiple diverticula, use of nonsteroidal anti-inflammatory drugs (NSAIDs), and the location of diverticula [20, 30, 31, 34]. Buchs et al. reported that an elevated serum level of CRP (over 240 mg/L) was associated with early recurrence (hazard ratio [HR], 1.75; 95% CI 1.04–2.94) [32]. The present study showed that multiple diverticula, size of diverticulum > 12 mm, and serum CRP level > 40 mg/L were not predictive factors for recurrence. In contrast, fever (body temperature > 37.8 °C), a marker for inflammation, was associated with a higher recurrence rate (OR, 11.233; 95% CI, 1.291–97.710; *P* = 0.028).

A limitation of our study was the possible risk of attrition bias. First, although we tried to complete follow-up by phone in those patients who did not revisit the clinic, several patients did not undergo follow-up CT. Second, we did not collect long-term follow-up data, and the scheduled contact period was relatively short (approximately 7 weeks). Therefore, after patient enrollment was complete, we also retrospectively reviewed the medical records until March 2018. Although the recurrence rate was similar to those reported in previous studies [31, 37], we acknowledge that the enrolled patients could have transferred to another clinical center and become lost to follow-up. A third limitation is that all of the patients were Korean. As mentioned above, because diverticulitis can present differently according to race, our results (in patients with uncomplicated right-sided diverticulitis not receiving antibiotics) should be interpreted with caution. However, despite the small sample size and short-term follow-up period, the present study provides evidence that treatment without antibiotics in uncomplicated right-sided colonic diverticulitis may be appropriate. Further research is required, including a prospective randomized clinical trial with a larger sample size, a longer follow-up period, and a range of participants from different races to evaluate the safety and efficacy of conservative management without antibiotics for uncomplicated right-sided diverticulitis.

Conclusion

In patients with uncomplicated right-sided colonic diverticulitis, conservative management without antibiotics showed similar treatment failure rates and length of hospital stay, and was associated with lower hospital costs, compared with standard antibiotic treatment. Therefore, conservative management can be considered a safe treatment option in these patients.

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