ORIGINAL ARTICLE

Predictive Factors of Recurrence in Non-Operative Management of Right-Side Colonic Diverticulitis: Multicenter Retrospective Cohort Study

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Background: Non-operative management (NOM) is the primary treatment strategy for uncomplicated right-sided colonic diverticulitis (RCD). However, some patients experience recurrence after successful NOM.

Objective: To investigate the recurrence rate and predictive factors for RCD after successful NOM.

Materials and Methods: A retrospective review was conducted on medical records of patients diagnosed with uncomplicated RCD at Vajira Hospital and Maharaj Nakorn Chiang Mai Hospital between January 2017 and December 2022. Predictive factors for recurrence were analyzed using multivariable Cox regression, and recurrence-free survival was evaluated using Kaplan-Meier analysis.

Results: Ninety patients were diagnosed with uncomplicated RCD, of whom 87 (96.7%) achieved successful NOM. The mean follow-up duration was 56.42 months (SD 18.89). Twelve patients (13.8%) experienced recurrence, with a median recurrence time of 11.5 months (IQR 5.7 to 31.7). There were no significant differences in baseline characteristics between the patients with and without recurrence. Smoking was significantly associated with recurrence (HR 4.56, 95% CI 1.33 to 15.6, p=0.02), with smokers showing lower recurrence-free probabilities at 12, 24, and 60 months compared to non-smokers with 72.7% versus 92.2% at 60 months. Hepatic flexure diverticulitis was also a significant predictor of recurrence (HR 4.59, 95% CI 1.17 to 11.94, p=0.03).

Conclusion: In the two-centers study from Thailand, smoking and hepatic flexure involvement were significant predictive factors for recurrence in RCD after successful NOM. These findings highlight the need for close monitoring and tailored management strategies in high-risk patients, and future studies should incorporate larger, multi-center data to validate these results.

Keywords: Right-side colonic diverticulitis; Predictive factors; Non-operative management

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Diverticular disease is a common condition of the colon caused by changes in the colonic wall, leading to the outpouching lesion from the intestinal wall. It is believed to result from increased intraluminal pressure and can occur throughout the entire length of the colon[1]. Pathologically, diverticular disease is classified into two types, false and true diverticulosis. False diverticulosis is defined as when only the inner layer of the colon wall protrudes outward. This type is more prevalent in populations living in Europe and America and associated with aging. True diverticulosis is defined as when all layers of the colonic wall protrude outward. This type is more commonly found in Asian populations and is often seen in younger individuals or as a congenital condition[2].

Diverticulitis is a symptomatic cases that often occurs due to diverticular inflammation. Uncomplicated diverticulitis presents mild symptoms such as abdominal pain and nausea/vomiting. Complicated diverticulitis includes severe conditions such as intra-abdominal abscesses, perforation of diverticula, peritonitis, and sepsis[3].

Hinchey et al.[4] classified colonic perforations

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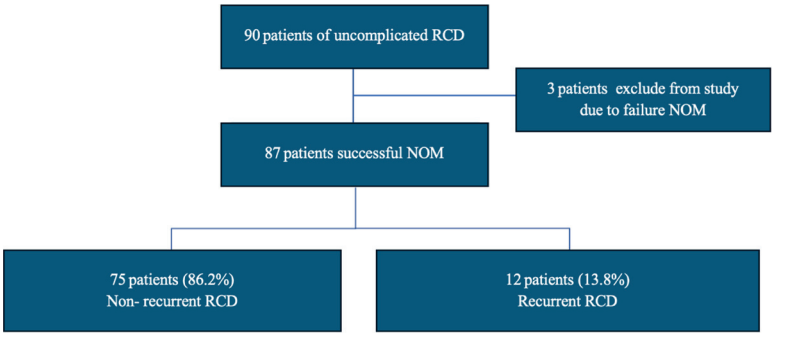


Figure 1. Flow diagram of patient cohort.

caused by diverticulitis into four stages based on severity for serving as a guideline for surgeons in deciding between conservative treatment and surgical intervention. Kaiser et al.[5] introduced the Modified Hinchey Classification (MHC), incorporating computed tomography (CT) scan findings to aid in assessing disease severity. This helps reduce unnecessary surgeries and postoperative complications:

Non-operative management (NOM) is the main strategy treatment for uncomplicated right-sided colonic diverticulitis (RCD)[6]. However, 7% to 20% of patients developed recurrent RCD after success NOM. Courtot et al. (2019) studied 93 patients with RCD. Among 59 patients treated conservatively, the recurrence rate was 6.8%[7]. Lee et al. conducted a systematic review (1990 to 2020) of 2,811 patients with uncomplicated RCD, finding a recurrence rate of 10.9% and a treatment failure rate of 2.5%[8]. Oh et al. (2012 to 2020) found a 5-year recurrence rate of 20.5% in acute RCD. Risk factors included complicated diverticulitis as MHC stage 1b and above, and those undergoing percutaneous drainage (PCD) intervention[9,10].

The present study examined the recurrence rate of RCD in patients treated with NOM. Additionally, it investigated the factors influencing recurrence in the non-surgical treatment of RCD.

Materials and Methods

The present study was approved by the Ethic Committee of Faculty of Medicine, Chiang Mai University (COA350/2024) and Vajira Internal Board Review (COA233/2024). The authors retrospectively reviewed the medical records of patients diagnosed with uncomplicated RCD in Faculty of Medicine Vajira Hospital, Navamindradhiraj University, Bangkok and Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand between January 2017 and December 2022. Acute RCD was classified in two types of uncomplicated and complicated right-side diverticulitis according to whole abdominal CT. Exclusion were patients who refused hospital admission for treatment and who underwent surgical treatment. The following clinical characteristics were recorded, age, gender, underlying disease, history of smoking, diverticulitis grading according to MHC, and location of diverticulitis. Patients who successfully NOM were follow-up and divided into two groups, recurrent and non-recurrent. The recurrent was diagnosed with clinical symptoms and confirmed by whole abdominal CT.

Statistical analysis

Statistical analyses were performed by using Stata Statistical Software, version 18 (StataCorp LLC, College Station, TX, USA). For comparisons between groups, categorical data was typically presented using count (n) and percentage (%), For continuous data, it was best represented using mean and standard deviation (SD). The authors evaluated the predictive factors of recurrent for uncomplicated RCD by cox regression and recurrent free were analyzed by Kaplan-Meier analysis. A p-value of less than 0.05 was considered statistically significant.

Results

Ninety patients were diagnosed with uncomplicated RCD, but three patients were excluded from the study due to failure of NOM as progressive peritonitis or sepsis. Eighty-seven patients achieved successful NOM (Figure 1). The mean follow-up duration was 56.42 months (SD 18.89). Twelve patients (13.8%) experienced recurrence, with a median recurrence time of 11.5 months (IQR 5.7 to 31.7). There were no significant differences in age, gender, underlying disease, BMI, exercise, MHC, location of diverticulitis, duration of intravenous

Table 1. Patient characteristic

	Total (n=87)	No recurrence (n=75)	Recurrence (n=12)	p-value
Age (years); median (IQR)	60 (49 to 67)	60 (52 to 67)	55.5 (45 to 69)	0.58
Age group; n (%)				0.37
<50	22 (25.3)	17 (22.7)	5 (41.7)	
50 to 59	21 (24.1)	19 (25.3)	2 (16.7)	
≥60	44 (50.6)	39 (52.0)	5 (41.7)	
Female; n (%)	47 (54.0)	40 (53.3)	7 (58.3)	0.75
Underlying disease; n (%)				
DM	19 (21.8)	16 (21.3)	3 (25.0)	0.77
HT	38 (43.7)	32 (42.7)	6 (50.0)	0.63
DLP	35 (41)	31 (41.3)	4 (33.3)	0.60
CVA	8 (9.2)	7 (9.3)	1 (8.1)	0.91
BMI (kg/m^2); median (IQR)	24.4 (22.2 to 27.3)	24.3 (22.2 to 26.7)	25.7 (22.1 to 29.8)	0.34
BMI group; n (%)				0.65
<18.5	5 (5.7)	5 (6.7)	0 (0.0)	
18.5 to 22.9	24 (27.6)	20 (26.7)	4 (33.3)	
23 to 24.9	19 (21.8)	17 (22.7)	2 (16.7)	
25 to 29.9	32 (36.8)	28 (37.3)	4 (33.3)	
≥30	7 (8.1)	5 (6.7)	2 (16.7)	
Exercise; n (%)	36 (41.4)	32 (42.7)	4 (33.3)	0.54
Alcohol; n (%)	28 (32.2)	21 (28.0)	7 (58.3)	0.04
History of smoking; n (%)	32 (36.8)	24 (32.0)	8 (66.7)	0.02
NSAIDs; n (%)	1 (1.2)	1 (1.3)	0 (0.0)	0.68
PPI; n (%)	1 (1.2)	1 (1.3)	0 (0.0)	0.68
MHC; n (%)				0.68
1A	74 (85.1)	63 (84.0)	11 (91.7)	
1B	9 (10.4)	8 (10.7)	1 (8.3)	
2	4 (4.6)	4 (5.3)	0 (0.0)	
Location; n (%)				
Cecum	48 (55.2)	43 (57.3)	5 (41.7)	0.31
Ascending	53 (60.9)	48 (64.0)	5 (41.7)	0.14
Hepatic	9 (10.3)	6 (8.0)	3 (25.0)	0.11
WBC; median (IQR)	11,670 (9,300 to 14,100)	11,610 (9,300 to 13,970)	11,965 (9,535 to 15,045)	0.56
PMN; median (IQR)	75.8 (70.2 to 80.5)	76 (70.8 to 80.4)	75 (67.9 to 83.1)	0.91
Albumin; median (IQR)	3.4 (0 to 4.1)	3.3 (0 to 4)	3.6 (0 to 4.2)	0.47
ATB; n (%)				0.83
<3 days	24 (27.6)	21 (28.0)	3 (25.0)	
≥3 days	63 (72.6)	54 (72.0)	9 (75.0)	
LOS; median (IQR)	5 (4 to 8)	5 (4 to 8)	6 (4.5 to 7.5)	0.74

IQR=interquartile range; DM=diabetes mellitus; HT=hypertension; DLP=dyslipidemia; CVA=cardiovascular disease; BMI=body mass index; NSAIDs=non-steroidal anti-inflammatory drugs; PPI=proton pump inhibitor; MHC=Modified Hinchey Classification; WBC=white blood cell; PMN=polymorphonuclear; ATB=antibiotic; LOS=length of hospital stay

antibiotic, and length of hospital stay between patients with and without recurrence. History of smoking and alcohol consumption were observed significantly in the recurrent group (Table 1).

Univariate analysis revealed history of smoking, alcohol consumption, and hepatic flexure location of RCD were markedly associated with recurrence episode in patient diagnosed with uncomplicated RCD and successful NOM (Table 2).

The authors further conducted a multivariate analysis to identify predictive factors. Based on the results of univariate analysis, history of smoking, alcohol consumption, and hepatic flexure location of RCD were not found to be significantly different ($p<0.1$). These factors were considered for multivariate analysis, which reveal that smoking was

Table 2. Predictive factor associated with recurrence

	Univariable		Mutivariable	
	HR (95% CI)	p-value	aHR (95% CI)	p-value
Age <50 years	2.28 (0.73 to 7.21)	0.16		
Female	1.21 (0.38 to 3.81)	0.75		
DM	1.26 (0.34 to 4.67)	0.73		
HT	1.26 (0.41 to 3.94)	0.68		
DLP	0.70 (0.21 to 2.31)	0.56		
CVA	0.95 (0.12 to 7.41)	0.97		
BMI ≥30 kg/m^2	2.24 (0.49 to 10.25)	0.30		
Exercise	0.74 (0.22 to 2.47)	0.63		
History of smoking	3.76 (1.1 to 12.49)	0.03	4.56 (1.33 to 15.6)	0.02
Alcohol	2.23 (1.03 to 10.19)	0.04		
MHC				
1A	1	Ref.		
1B	0.74 (0.10 to 5.74)	0.77		
2	NA			
Cecum	0.55 (0.17 to 1.74)	0.31		
Ascending	0.44 (0.14 to 1.39)	0.16		
Hepatic flex	3.22 (0.87 to 12.0)	0.08	4.59 (1.17 to 17.94)	0.03
WBC >10,000	0.93 (0.28 to 3.08)	0.94		
PMN ≥80	1.38 (0.42 to 4.59)	0.60		
Albumin <3	0.62 (0.19 to 2.09)	0.45		
ATB ≥3 days	1.08 (0.29 to 4.00)	0.91		

HR=hazard ratio; aHR=adjusted hazard ratio; CI= confidence interval; DM=diabetes mellitus; HT=hypertension; DLP=dyslipidemia; CVA=cardiovascular disease; BMI=body mass index; MHC=Modified Hinchey Classification; WBC=white blood cell; PMN=polymorphonuclear; ATB=antibiotic

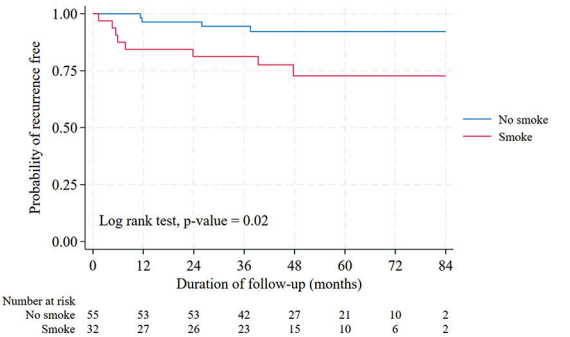
Cox regression was analyzed univariable and multivariable. Multivariable were developed by covariate with p<0.1 from univariable and using stepwise back ward LR to select final model.

significantly associated with recurrence (HR 4.56, 95% CI 1.33 to 15.6, p=0.02), with smokers showing lower recurrence-free probabilities at 12, 24, and 60 months compared to non-smokers with 72.7% versus 92.2% at 60 months (Figure 2). Hepatic flexure diverticulitis was also a significant predictor of recurrence (HR 4.59, 95% CI 1.17 to 11.94, p=0.03).

Discussion

NOM remains the cornerstone of treatment for uncomplicated RCD, and the present study reinforces its high success rate of 96.7%, which is consistent with existing literature reporting success rates between 90% and 97%[11-14]. This reflects the increasing consensus that uncomplicated RCD, particularly prevalent in Asian populations, can be safely managed without surgery, provided that close monitoring and supportive care, including intravenous antibiotics, fluid resuscitation, bowel rest, and PCD when indicated, are applied.

However, the recurrence rate in the present study cohort, which was at 13.8%, is slightly higher than those reported by Courtot et al. at 6.8% and



Months	No smoke	Smoke
12	96.4 (86.2 to 99.1)	84.4 (66.5 to 93.2)
24	96.4 (86.2 to 99.1)	81.3 (62.9 to 91.1)
36	94.5 (83.9 to 98.2)	81.3 (62.9 to 91.1)
48	92.2 (80.4 to 97.0)	72.7 (52.1 to 85.6)
60	92.2 (80.4 to 97.0)	72.7 (52.1 to 85.6)

% of recurrence free (95% CI), Recurrence free was calculated by Kaplan-Meier

Figure 2. Probability of recurrence free for patient in non-operative management of right-side colonic diverticulitis by history of smoke.

Kim et al. at 10.4%[7,13], though still within the broader range found in prior studies, which is between 5.4% and 19.1%[11,12,15-19]. The variation may reflect differences in patient demographics, diagnostic thresholds, or follow-up duration. Notably, the median time to recurrence in the present study population was 11.5 months, supporting the need for at least one to two years of follow-up in patients initially treated non-operatively.

An important finding in the present study is the significant association between smoking and increased recurrence risk, with a hazard ratio of 4.56 (95% CI 1.33 to 15.6, p=0.02). This is consistent with studies showing that smoking contributes to persistent low-grade colonic inflammation, impaired mucosal healing, and microvascular ischemia, all of which may predispose to recurrence or delayed resolution of diverticulitis[20,21]. However, limitations in the present study dataset, including lack of data on smoking quantity and duration, make it difficult to determine a clear dose-response relationship. Future prospective studies should aim to capture such behavioral factors more rigorously.

Interestingly, hepatic flexure involvement emerged as another independent predictor of recurrence (HR 4.59, 95% CI 1.17 to 11.94, p=0.03). This segment of the colon represents an anatomically complex transition zone with sharp angulations, variable vascular supply, and increased colonic mobility, all of which may contribute to inadequate perfusion or mechanical stress during episodes of inflammation. While this association is novel and warrants validation, it suggests that hepatic flexure diverticulitis may require a more tailored management strategy. Early surgical consultation or prophylactic intervention could be considered in recurrent cases involving this region, particularly when compounded by modifiable risk factors such as smoking.

Despite the strengths of the present study findings, including a multicenter design and clearly defined inclusion criteria, the present study is not without limitations. First, its retrospective nature introduces potential selection and information biases. Incomplete documentation, particularly regarding smoking and alcohol use, may have limited the accuracy of the multivariate analyses. Second, the sample size was small, which may restrict generalizability and limit statistical power to detect other significant associations. Furthermore, the two centers involved in the present study may have had variations in clinical protocols or patient populations, influencing the outcomes.

Conclusion

In conclusion, the present study underscores the effectiveness of NOM for uncomplicated right-sided diverticulitis and also highlights subgroups at elevated risk for recurrence, particularly smokers and those with hepatic flexure involvement. These findings support the need for individualized treatment planning, potentially incorporating earlier surgical consultation or structured follow-up for high-risk patients. Further prospective studies with larger populations, standardized management pathways, and detailed lifestyle data are necessary to refine recurrence risk stratification and long-term care strategies in RCD.

What is already known about this topic?

NOM is the primary treatment for uncomplicated RCD. However, recurrence can still occur even after successful NOM.

What does this study add?

A history of smoking and the location of RCD at the hepatic flexure are significant factors influencing recurrence after NOM. These factors can help guide surgeons in planning appropriate management strategies.

Conflicts of interest

The authors declare no conflict of interest.

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