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Research Article

Short- and long-term outcomes in the nonoperative treatment of diverticular abscesses☆

Arshad M. Bachelani [a,1,*], Laura A. Holton [b], Youssef Soliman [c]

[a] Penn Highlands Mon Valley, 1163 Country Club Road, Monongahela, PA 15063, USA
[b] Lake Erie College of Osteopathic Medicine, 20 Seton Hill Drive, Greensburg, PA 15601, USA
[c] Assiut University, 55PC+X4V, El Fateh, Assiut Governorate, 71515, Egypt

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ABSTRACT

Introduction: Recommendations for surgery of diverticular abscesses continue to evolve. This study aimed to examine the short- and long-term results of nonoperative management of diverticular abscesses while analyzing granular data to assess for predictive factors for successful treatment.
Materials and methods: We analyzed patients admitted with diverticular abscesses at Penn Highlands Mon Valley Hospital from 2010 to 2020 who received initial planned nonoperative management. Short-term failure was defined as requiring surgery within 60 days of diagnosis, whereas long-term failure was defined as requiring surgery beyond 60 days. Successful treatment was defined as treatment that did not require surgery.
Results: In total, 857 patient charts were individually analyzed. Sixty-three patients met the inclusion criteria. The median follow-up period was 48 months. Nineteen (30.2%) patients experienced short-term failure of nonoperative management, whereas 6 (9.5%) patients experienced long-term failure. Surgery was successfully avoided in the remaining 41 (60.3%) patients. Abscess size was significantly associated with success rate (< 3 cm, 85.7%; 3–5 cm, 42.3%; > 5 cm, 33.3%; $p = 0.001$). When corrected for the abscess size, percutaneous drainage did not affect the requirement for eventual surgery.
Conclusions: Nonoperative management is a reasonable option for diverticular abscesses and is particularly successful in patients with abscesses < 3 cm in diameter. Although sometimes performed in conjunction with nonoperative management, percutaneous drainage does not decrease the requirement for eventual surgery. Elective surgery should be considered for patients with larger abscesses. Future prospective studies may further clarify the role of the nonoperative management of diverticular abscesses.

Introduction

Acute diverticulitis accounts for 250,000 hospital admissions and $3 billion in annual healthcare costs annually [1]. With the aging population, these numbers continue to increase. Diverticular abscesses are a complication of acute diverticulitis, and recommendations regarding their initial nonoperative management remain controversial.

Traditionally, elective colon resection surgery was recommended to patients treated for diverticular abscesses to prevent recurrence and complications [2]. Moreover, surgery was recommended to prevent future episodes of complicated diverticulitis and its associated risks. The most recent iteration of the American Society of Colon and Rectal Surgeons guidelines states that elective resection should be considered after a diagnosis of diverticular abscess [3]. The recurrence rate of diverticular abscess is approximately 30% [4], but there is a lack of studies specifying the factors that predict recurrence. Specific factors, including demographics, comorbidities, size, location, and history of an abscess, may play a role in the likelihood of future recurrence. Complicated diverticulitis with diverticular abscesses is associated with significant morbidity and mortality [5]. Surgery itself also has risks, such as anastomotic leak, stoma formation, future reoperation, or death [6]. Additionally, advancements in medical technology and imaging have challenged this past recommendation as they have the potential to be low-risk and safe alternatives to elective colectomies [4].

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* Corresponding author.
E-mail address: abachelani@excelahealth.org (A.M. Bachelani).
[1] Present address: 463 McCombs Road, Venetia, PA 15367, USA.

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To date, some studies have examined the outcomes of utilizing observations for the initial management of diverticular abscesses. Elagili et al. and Gaertner et al. concluded that observation after percutaneous drainage (PD) was a safe and low-risk option for selecting patients with diverticular abscess [5,7]. Garfinkle et al. supported nonoperative management as a safe long-term solution, especially in emergency setting [4]. However, there continues to be a debate on the best practice for short- and long-term treatments of diverticular abscesses owing to the small number of studies, short follow-up, or lack of generalizability to a larger patient population.

This study aimed to determine the short- and long-term success rates of diverticular abscesses when managed nonoperatively. This study also reviewed factors that might have a predictive value for determining future recurrence rates, which can help guide protocols for the treatment of diverticular abscesses.

Materials and methods

This study was conducted at Penn Highlands Mon Valley Hospital in Monongahela, Pennsylvania. The present study was approved by the Institutional Review Board of Lake Erie College of Osteopathic Medicine and a waiver of informed consent was obtained. Patients admitted from January 1, 2010, to December 31, 2020, with a diagnosis of diverticular abscess were evaluated. The initial query of patients was performed utilizing the diagnostic codes of ICD-9-CM 532.11 prior to October 1, 2015, and diagnostic codes of 57.20 or 57.80 after October 1, 2015. Each patient chart was individually analyzed to identify patients who presented with diverticular abscesses. Patients who elected to undergo elective colectomy were excluded, as were those who were treated operatively as initial management upon presentation. Patients with a colonic malignancy and were also excluded, as were those with contained perforations rather than diverticular abscesses based on an individual review of each patient's computed tomography scan.

The primary outcomes of this study were rates of successful treatment, long-term failure, and short-term failure. Successful treatment was defined as no recurrence of the disease at all or recurrence not requiring surgery. Long-term failure was defined as the requirement for surgery beyond 60 days, whereas short-term failure was defined as the requirement for surgery before 60 days. The secondary endpoints were the rate of requirement for surgery, recurrence rate, and median recurrence time.

All statistical analyses were performed using RStudio (RStudio, Boston, MA, USA). Continuous data are presented as medians with ranges (25th–75th percentile), whereas categorical data are presented as numbers and percentages. The Mann–Whitney U test and Kruskal–Wallis test were used to analyze the continuous data, whereas Fisher's exact test was used to analyze the categorical data. Univariate and multivariate logistic regression models were used to test for factors that predicted recurrence and the requirement for surgery after conservative treatment of the first attack. The Kaplan–Meier curve and Cox proportional hazards model were used to analyze recurrence-free survival and associated factors. A $p < 0.05$ was considered significant.

Results

Baseline characteristics

In total, 857 patient charts meeting the ICD-9 and ICD-10 inclusion codes were individually analyzed. Several of these patients, particularly those with ICD-9 codes, had uncomplicated diverticulitis. After excluding other patients based on the above criteria, which included two patients who were later found to have malignancy, 63 patients were included in our analysis. The median patient age was 61 (interquartile range [IQR], 53–74) years. In total, 46 (73%) patients were female. The median abscess size for all patients was 3.20 (IQR, 2–4.55) mm. Percutaneous drainage was performed in 16 (25.4%) patients. No patient died during the follow-up period. The median follow-up period for patients who did not experience short-term failure was 42 (IQR, 17–77) months. A summary of the baseline characteristics of the patients is presented in Table 1.

Main outcomes

Nineteen (30.2%) patients had a short-term failure of nonoperative management requiring colectomy, whereas 6 (9.5%) patients had a long-term failure. The remaining 38 (60.3%) patients successfully managed to avoid surgery. Six of these patients had another episode of diverticulitis that was managed nonoperatively, whereas the rest were recurrence-free. The median follow-up period for patients who did not experience a short-term failure was 48 (IQR, 20.75–80.75) months. The median time to recurrence was 9 (IQR 1–48.5) months for those who had recurrence of their disease. In total, 25 (39.7%) patients required surgery. Of these patients, 14 (56%) underwent colostomy (Table 2).

Subgroup analysis

By stratifying patients according to abscess size (< 3 cm, 3–5 cm, > 5 cm), the success rate was highest in the < 3-cm group (85.7%), followed by the 3–5-cm (42.3%) and > 5-cm (33.3%) groups ($p = 0.001$) (Fig. 1). The time to failure or recurrence significantly differed according to abscess size, where patients with abscess size < 3 cm had the longest time to recurrence at 23.5 (IQR, 8.75–64.75) months ($p = 0.002$) (Table 3).

When stratifying patients according to successful treatment, patients who failed nonoperative treatment or had a recurrent episode of diverticulitis differed from those who did not have a recurrence episode in terms of abscess size (4 [IQR, 2.55–4.90] mm in the recurrence group vs. 2.45 [IQR, 1.78–4.08] mm in the no recurrence group, $p = 0.012$). Percutaneous drainage was also associated with a higher recurrence/

Table 1
Baseline summary of the included participants.

		Overall ($n = 63$)
Age (median [IQR])		61.00 [53.00–74.00]
Race (%)	White	59 (93.6)
	Black	4 (6.4)
Sex (%)	Female	46 (73.0)
	Male	17 (27.0)
BMI (median [IQR])		28.45 [25.38–33.60]
Abscess size (median [IQR])		3.20 [2.00–4.55]
Abscess size category (%)	< 3 cm	28 (44.4)
	3–5 cm	26 (41.3)
	> 5 cm	9 (14.3)
# of abscesses (%)	1	58 (92.1)
	2	4 (6.3)
	3	1 (1.6)
Location (%)	Distant	15 (23.8)
	Local	48 (76.2)
Charlson Comorbidity Index score	0	11 (17.7)
	1	16 (25.8)
	2	9 (14.5)
	3	10 (16.1)
	4	11 (17.7)
	5	4 (6.5)
	6	1 (1.6)
Charlson Comorbidity Index score (median [IQR])	2.00 [1.00, 3.75]	2.00 [1.00–3.75]
Death (%)	No	63 (100.0)
Steroid use (%)	No	58 (92.1)
	Yes	5 (7.9)
Smoking (%)	No	44 (69.8)
	Yes	19 (30.2)
Percutaneous drainage (%)	No	47 (74.6)
	Yes	16 (25.4)

Table 2
Summary of main outcomes.

Primary outcomes (%)		$n = 63$
No recurrence		32 (50.8)
Recurrence not requiring surgery		6 (9.5)
Long-term failure		6 (9.5)
Short-term failure		19 (30.2)
Secondary outcomes (%)		Overall ($n = 63$)
Recurrence plus failure (%)	No	32 (50.8)
	Yes	31 (49.2)
Time to recurrence/failure (median [IQR])		9.00 [1.00–48.50]
Requirement for surgery (%)	No	38 (60.3)
	Yes	25 (39.7)
Ostomy (%)	No	11 (17.5)
	Yes	14 (22.2)
Ostomy reversed (%)	No	8 (12.7)
	Yes	6 (9.5)

failure rate ($p = 0.036$) (Table 4).

Regression analysis

We analyzed the factors predicting the requirement for surgery using logistic regression. We found that larger abscess size and PD were associated with a higher surgical risk. In the multivariate regression analysis corrected for abscess size, we found that PD was no longer significant (Table 5, Fig. 2).

Survival analysis

We performed a survival analysis to analyze recurrence/colectomy-free survival according to the abscess size category. We found statistically significant difference among the three categories (log-rank: $p = 0.016$). Applying the Cox proportional hazards model, we found that compared with patients with abscess size < 3 cm, those with abscess sizes 3–5 cm (hazard ratio [HR], 2.83; 95% confidence interval [CI], 1.25–6.43; $p = 0.01$) and > 5 cm (HR, 4.18; 95% CI, 1.48–11.92; $p = 0.007$) had a higher risk of failure or recurrence (Fig. 3).

Discussion

Nonoperative treatment versus elective resection for diverticular abscesses is currently being debated. Understanding predictive factors may help guide the decision-making process, especially for patients with intermediate severity compared with the more evident management of mild or severe cases. In the current study, we examined the failure rates when nonoperative treatment was performed and if there were factors that significantly predicted the need for future surgery. This study suggests that nonoperative treatment of diverticular abscesses may be a reasonable treatment option, particularly for patients with small (< 3 cm) abscesses. Within this group of patients, 85.7% had successful treatment outcomes after a median follow-up period of 42 months.

Overall, 60.3% of our patients had successful nonoperative management and were able to avoid surgery. For comparison, Mali et al. obtained a 69% success rate, and Garfinkle et al. reported that 87.7% of their patients did not require surgery [4,8]. Given the findings of previous studies and our own study's findings, nonoperative treatment remains reasonable and can be beneficial. In the short-term, 70% of our patients were able to successfully avoid surgery at 60 days. This is comparable to the success rate of 78.2% reported in a systematic review by Fowler et al. [9].

Including patients who required surgery both in the short- and long-term, this study also found a 49.2% recurrence rate within a median time to recurrence or failure of 9 months. In a meta-analysis by Lamb and Kaiser, recurrent symptoms were typically found within 3–6 months, and they found an overall recurrence rate of approximately 68% [10]. Devaraj et al. found a recurrence rate of 61% in 210 patients, with 44% requiring colectomy [11]. Gaertner et al. found a recurrence rate of 58%, with a higher recurrence associated with a larger abscess size [7]. Certainly, several studies should be further conducted to better determine which abscess characteristics allow for self-resolution versus recurrence; however, for this study, the timeframe for measuring recurrence seems adequate and is one of its strengths in establishing conclusions and long-term recommendations.

In the subgroup analysis to identify predictive factors, small abscesses showed a higher success rate, longer time to recurrence, and required surgery less often than large abscesses. A larger abscess size was associated with a higher risk of surgery and decreased time to

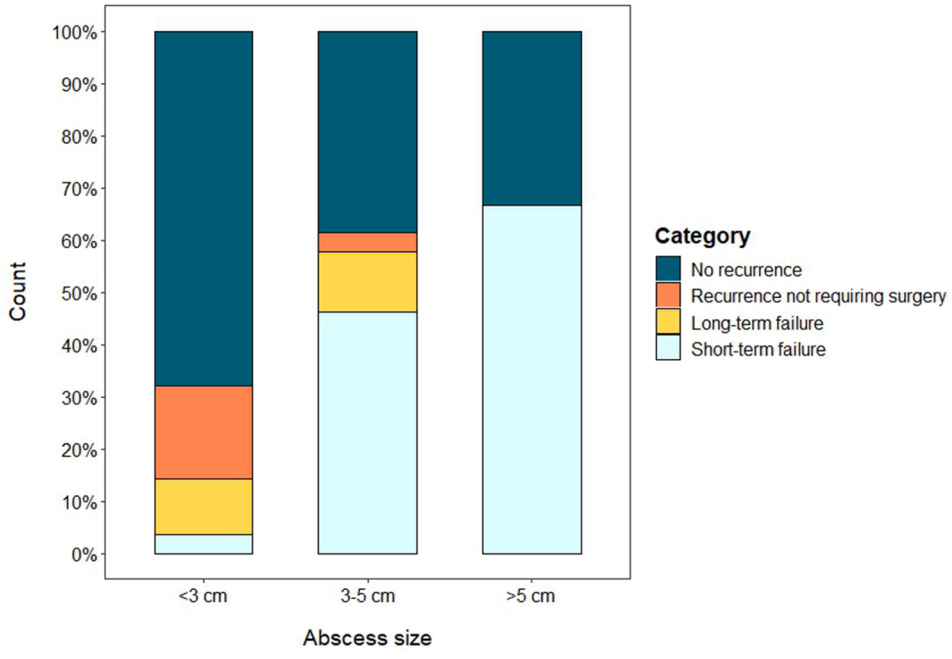

Fig. 1. Analysis of outcomes according to abscess size.

Table 3
Analysis according to abscess size.

	Level	< 3 cm (n = 28)	3–5 cm n = 26	> 5 cm n = 9	p
Category details (%)	Long-term failure	3 (10.7)	3 (11.5)	0 (0.0)	0.002
	No recurrence	19 (67.9)	10 (38.5)	3 (33.3)	
	Recurrent not requiring surgery	5 (17.9)	1 (3.8)	0 (0.0)	
	Short-term failure	1 (3.6)	12 (46.2)	6 (66.7)	
Category (%)	Long-term failure	3 (10.7)	3 (11.5)	0 (0.0)	0.001
	Short-term failure	1 (3.6)	12 (46.2)	6 (66.7)	
	Successful	24 (85.7)	11 (42.3)	3 (33.3)	
Charlson Comorbidity Index score		1.00 [1.00–4.00]	2.00 [0.25–3.00]	3.00 [3.00–4.00]	0.2
Age (median [IQR])		59.50 [53.50–74.00]	61.00 [48.00–68.75]	75.00 [61.00–84.00]	0.146
Sex (%)	Female	21 (75.0)	16 (61.5)	9 (100.0)	0.077
	Male	7 (25.0)	10 (38.5)	0 (0.0)	
BMI (median [IQR])		27.55 [25.25–33.40]	30.20 [28.00–36.00]	23.90 [21.90–29.00]	0.066
# of abscesses (%)	1	27 (96.4)	23 (88.5)	8 (88.9)	0.687
	2	1 (3.6)	2 (7.7)	1 (11.1)	
	3	0 (0.0)	1 (3.8)	0 (0.0)	
Location (%)	Distant	2 (7.1)	10 (38.5)	3 (33.3)	0.02
	Local	26 (92.9)	16 (61.5)	6 (66.7)	
Steroid use (%)	No	27 (96.4)	23 (88.5)	8 (88.9)	0.518
	Yes	1 (3.6)	3 (11.5)	1 (11.1)	
Smoking (%)	No	20 (71.4)	16 (61.5)	8 (88.9)	0.296
	Yes	8 (28.6)	10 (38.5)	1 (11.1)	
Percutaneous drainage (%)	No	28 (100.0)	18 (69.2)	1 (11.1)	< 0.001
	Yes	0 (0.0)	8 (30.8)	8 (88.9)	
Recurrence or failure (%)	No	19 (67.9)	10 (38.5)	3 (33.3)	0.05
	Yes	9 (32.1)	16 (61.5)	6 (66.7)	
Time to recurrence (median [IQR])		23.50 [8.75–64.75]	4.00 [1.00–41.50]	1.00 [1.00–4.00]	0.002
Requirement for surgery (%)	No	24 (85.7)	11 (42.3)	3 (33.3)	0.001
	Yes	4 (14.3)	15 (57.7)	6 (66.7)	

Table 4
Analysis by recurrence/failure vs. no recurrence.

	Level	Recurrence or failure (n = 31)	No recurrence (n = 32)	p
Age (median [IQR])		58.00 [47.00–68.50]	64.50 [56.50–76.50]	0.067
Sex (%)	Female	22 (71.0)	24 (75.0)	0.939
	Male	9 (29.0)	8 (25.0)	
BMI (median [IQR])		28.05 [24.57–32.88]	29.35 [25.60–34.20]	0.499
Size of abscess (median [IQR])		4.00 [2.55–4.90]	2.45 [1.78–4.08]	0.012
Abscess category (%)	< 3 cm	9 (29.0)	19 (59.4)	0.05
	3–5 cm	16 (51.6)	10 (31.2)	
	> 5 cm	6 (19.4)	3 (9.4)	
# of abscesses (%)	1	27 (87.1)	31 (96.9)	0.323
	2	3 (9.7)	1 (3.1)	
	3	1 (3.2)	0 (0.0)	
Location (%)	Distant	8 (25.8)	7 (21.9)	0.944
	Local	23 (74.2)	25 (78.1)	
Charlson Comorbidity Index score		1.00 [0.00–3.00]	2.00 [1.00–4.00]	0.02
Steroid use (%)	No	27 (87.1)	31 (96.9)	0.332
	Yes	4 (12.9)	1 (3.1)	
Smoking (%)	No	21 (67.7)	23 (71.9)	0.934
	Yes	10 (32.3)	9 (28.1)	
Percutaneous drainage (%)	No	19 (61.3)	28 (87.5)	0.036
	Yes	12 (38.7)	4 (12.5)	

Table 5
Logistic regression analysis for factors predicting the requirement for surgery.

Need for surgery – Model 1 (univariate)			
Variable	OR	95% CI	p-value
Age	0.98	[0.95–1.02]	0.4
Sex	Ref		
	2.11	[0.68–6.52]	0.2
BMI	0.95	[0.88–1.02]	0.18
Abscess size	Ref		
	8.18	[2.20–30.43]	0.001
	12	[2.10–68.63]	0.005
PD	Ref		
	5.19	[1.52–17.71]	0.009
Location	Ref		
	0.48	[0.15–1.55]	0.22
Steroid use	Ref		
	7.05	[0.74–67.25]	0.09
Smoking	Ref		
	1.16	[0.39–3.45]	0.8
Need for surgery – Model 2 (multivariate)			
Variable	OR	95% CI	p-value
Abscess size	Ref		
	6.68	[1.66–26.89]	0.008
	6.52	[0.68–62.03]	0.103
PD	Ref		
	2	[0.39–10.15]	0.402334

failure. Gaertner et al. and Devaraj et al. also concluded that a larger abscess size was significantly associated with a higher recurrence rate [7,11]. Given these findings, we can conclude that nonoperative conservative treatment for diverticular abscesses <3 cm in size is a safe, reasonable, and effective management protocol.

Some studies have considered PD as a potential option to reduce the requirement for surgery, particularly when the abscess is larger [10]. Some other studies have suggested that PD alone may be a sufficient treatment to avoid elective surgeries and their associated complications [5,7]. However, this study found that once the abscess size was corrected, PD was no longer associated with a decreased rate of recurrence or the requirement for surgery. Similarly, Mali et al. also concluded that PD with antibiotics was not superior to antibiotics alone and did not demonstrate an improvement in outcomes [8]. Deveraj et al. stated that PD may serve only as a bridge to surgery [11]. Overall, abscess size seems to be a more significant factor in predicting the requirement for future surgery and recurrence rates, and PD alone does not prevent future surgery or recurrence.

Notably, two patients were excluded as subsequent colonoscopy revealed a malignancy. This is concordant with the findings of Meyer

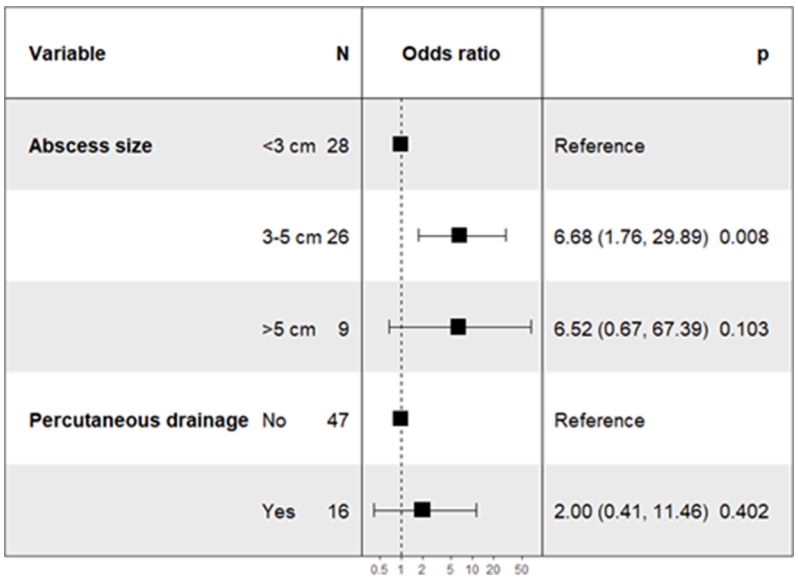

Fig. 2. Multivariate regression for factors predicting the need for surgery.

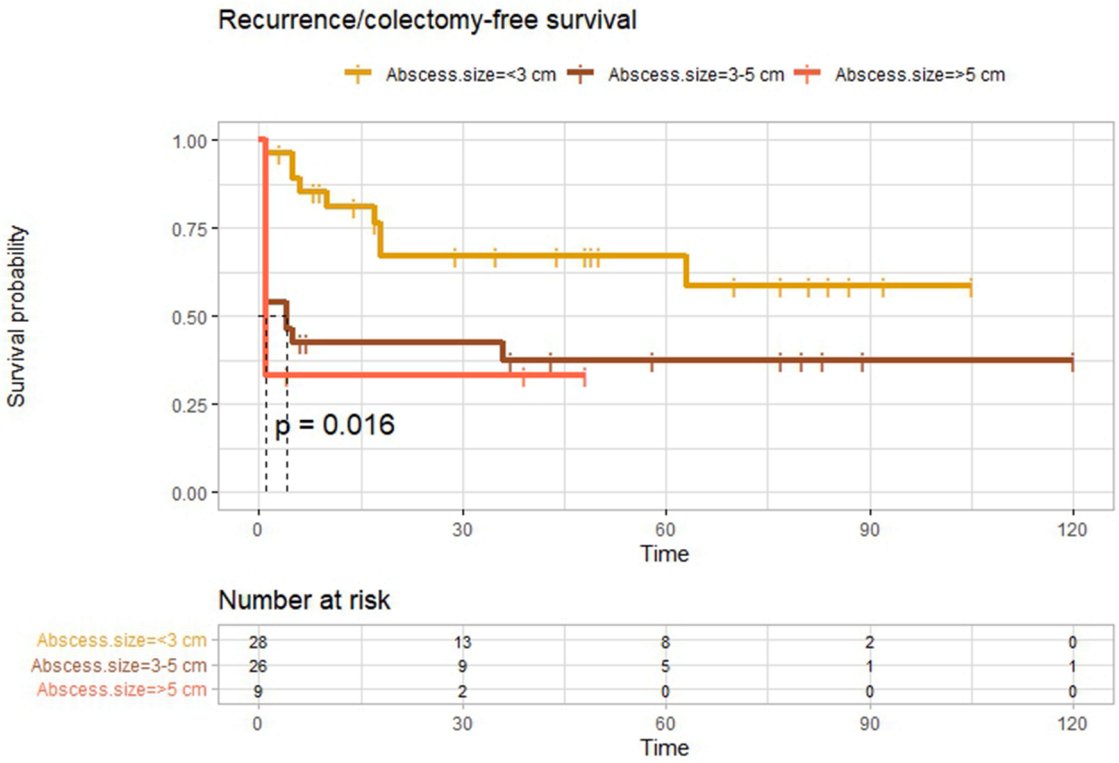

Fig. 3. Recurrence/colectomy-free survival according to abscess size; p-value is for log-rank test.

et al., who reported that patients with complicated diverticulitis had a 7.9% chance of harboring a malignancy [12]. Therefore, when selecting nonoperative treatment for diverticular abscesses, the importance of subsequent endoscopic evaluation cannot be overemphasized.

Limitations

Despite having advantages, such as the ability to analyze granular data, the limitations of this study include its modest sample size and retrospective design. A selection bias inherently exists; more complicated or severe diseases may have had a stronger push to be treated surgically instead of nonoperatively, leading our patient pool to consist of those who would be good candidates for conservative treatment. Future studies should further prospectively assessed the use of nonoperative treatment for small abscesses compared with elective resection to ultimately establish a treatment protocol. Other factors, such as long-term health costs for nonoperative treatment and patient-reported symptom improvement, may be included in future studies.

Conclusion

In this retrospective study, nonoperative treatment of acute

diverticulitis leads to successful patient outcomes, demonstrating its potential as a treatment recommendation. Conservative treatment appears to be particularly beneficial for patients with small (< 3 cm) abscesses who demonstrate a higher successful treatment rate and longer time to recurrence and require surgery significantly less often. Elective surgery should be considered for patients with larger abscesses. Future prospective studies should continue to examine the use of nonoperative options regarding long-term management and patient outcomes. These studies can help establish a protocol for nonoperative treatment recommendations.

Author contributions

All authors have made significant contributions towards this manuscript. First author conceived of the idea initially, all authors developed the idea further, last author performed statistical analyses, all authors took part in writing the manuscript. All authors approved final draft of the manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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