



Perforated diverticulitis: is the right and left difference present here too?

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Abstract

Background It is unclear if location of disease matters in perforated diverticulitis. Management guidelines for perforated diverticulitis currently do not make a distinction between right perforated diverticulitis (RPD) and left perforated diverticulitis (LPD). We aim to compare disease presentation and management outcomes between RPD and LPD.

Methods This was a 10-year retrospective comparative cohort study of 99 patients with acute perforated diverticulitis between 2004 and 2013 in a single institution. Patients were divided into RPD and LPD groups based on location of disease and compared. Disease presentation was compared using modified Hinchey classification. Management outcomes assessed were failure of therapy, length of stay, mortality, surgical complications, and disease recurrence. Univariate analysis was performed using Student's *t* test and χ^2 test where appropriate.

Results RPD patients were younger (45.7 ± 16.1 versus 58.3 ± 14.7 years) and presented with lower modified Hinchey stage and no Hinchey IV diverticulitis when compared to LPD (14.3% Hinchey III versus 44.0% Hinchey III or IV). Conservative management of Hinchey I and II RPD and LPD was similarly successful (96.1 versus 96.5%), although RPD patients had shorter inpatient stay (4.6 ± 2.2 versus 6.3 ± 3.8 days) and less disease recurrence (3.1 versus 17.9%). Ten (20.4%) Hinchey I and II RPD patients were initially misdiagnosed with appendicitis and underwent surgery.

Conclusion LPD is a more aggressive disease presenting with greater clinical severity in older patients and is associated with frequent disease recurrence when treated conservatively. Misdiagnosis of RPD as appendicitis is common and may lead to unnecessary surgery.

Keywords Perforated diverticulitis · Acute diverticulitis · LPD · Hinchey · RPD

Introduction

Majority of patients with colonic diverticulitis in Asia have right-sided disease, unlike predominantly left-sided disease in the West [1–8]. Studies to date comparing right and left diverticulitis have looked at mixed cohorts of both uncomplicated and complicated patients, finding older age and complications to be more common in left-sided diverticulitis [9–12].

We are interested in whether a right and left difference is present specifically in perforated diverticulitis, the most common form of complicated diverticulitis [13]. Current clinical

practice guidelines do not make a distinction between right and left perforated diverticulitis [14, 15]. As the role of conservative management in perforated diverticulitis continues to grow, our purpose is to examine if a right and left difference in disease presentation and outcomes exists that may impact how we manage perforated diverticulitis in our population, which has a higher proportion of right-sided disease [16–18].

The aim of this study was to compare modified Hinchey stage and management outcomes between right perforated diverticulitis (RPD) and left perforated diverticulitis (LPD) in a 10-year cohort of patients.

Materials and methods

This was a retrospective comparative cohort study of RPD and LPD. All patients who presented to our hospital with acute perforated diverticulitis from 2004 to 2013 were identified via electronic medical records and included in the study. Fifteen

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patients presenting with other complications of fistulas or strictures were not included. The diagnosis of acute perforated diverticulitis was confirmed either by intra-operative findings for patients who underwent surgery or by computed tomography for those treated non-operatively.

The cohort of patients was split into two groups based on location of disease, where right-sided diverticulitis was defined as occurring between cecum and splenic flexure. In our institution, patients without generalized peritonitis (Hinchev I and II) were treated conservatively with antibiotics and percutaneous drainage of abscess when indicated, while patients with generalized peritonitis (Hinchev III and IV) were treated surgically.

Relevant information on patient demographics and immediate management outcomes were obtained from inpatient case notes. Operative findings and computed tomography scan reports were also reviewed and Hinchev stage determined using the modified Hinchev classification by Wasvary et al. [19]. All patients were followed up until 1 January 2016 for subsequent disease recurrence. This was possible with the use of a national electronic medical records platform, which included both inpatient and outpatient visits to all national hospitals in our country.

Statistical analysis where appropriate was performed using chi-square test for categorical variables and Student's *t* test for continuous variables.

Results

Between 2004 and 2013, 99 patients were identified with acute perforated diverticulitis of which 49 patients had RPD and 50 had LPD.

Patient characteristics

Right-sided diverticulitis patients were significantly younger than their left-sided counterparts (45.7 versus 58.3 years, $p < 0.001$). Otherwise, both cohorts had similar gender profiles, with a predilection for males (1.75 male:1 female).

Comparison of age and gender between right-sided and left-sided disease cohorts is represented in Table 1.

Table 1 Age and gender characteristics of patient cohort

	Total (<i>n</i> = 99)	Right colon (<i>n</i> = 49)	Left colon (<i>n</i> = 50)	<i>p</i>
Age (years)	52.1 ± 16.6	45.7 ± 16.1	58.3 ± 14.7	< 0.001
Gender (male:female)	63:36	31:18	32:18	0.939

Modified Hinchev stage

Twenty-two LPD patients (44.0%) presented with Hinchev stage III or IV diverticulitis compared to just seven patients with Hinchev stage III diverticulitis (14.3%) in RPD. None of the RPD patients had Hinchev stage IV diverticulitis. This was statistically significant ($p = 0.003$) with relative risk ratio of 3.08 (95% confidence interval: 2.14 to 7.83).

Modified Hinchev classification as applied to RPD and LPD cohorts is shown in Fig. 1.

Modified Hinchev classification by Wasvary et al. is shown in Table 2.

Management

Patients with Hinchev I and II diverticulitis were treated conservatively while patients with Hinchev III and IV diverticulitis were treated surgically. The exception to this was 10 RPD patients (20.4%) who initially had a clinical diagnosis of appendicitis and therefore underwent surgery as their immediate treatment. All 10 misdiagnosed patients were subsequently found to have Hinchev I or II perforated diverticulitis.

Conservative therapy

Patients with Hinchev I and II diverticulitis were treated with antibiotics, and 2 patients had percutaneous drainage of abscess (1 RPD and 1 LPD). Failure conservative therapy with conversion to urgent surgery was uncommon in both cohorts (3.1% in RPD and 3.5% in LPD), but subsequent recurrence of diverticulitis was more common in left-sided disease (3.1% in RPD versus 17.9% in LPD, $p = 0.102$), with a median follow-up period of 76 ± 27 months that was similar between both cohorts. In addition, RPD patients also had shorter inpatient stays than LPD patients (4.6 versus 6.3 days, $p = 0.043$).

Conservative management outcomes of RPD and LPD are represented in Table 3.

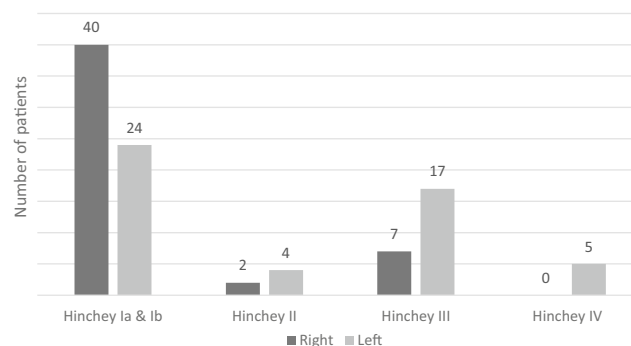


Fig. 1 Disease severity as classified by modified Hinchev classification

Table 2 Modified Hinchey classification by Wasvary et al. [19]

Stage	Description
Ia	Confined pericolic inflammation or phlegmon
Ib	Pericolic or mesocolic abscess
II	Pelvic, distant intra-abdominal or retroperitoneal abscess
III	Generalized purulent peritonitis
IV	Generalized fecal peritonitis

Surgical therapy

Emergency open surgery was performed for all patients with generalized peritonitis (Hinchey III or IV). All 7 RPD patients with Hinchey III disease underwent single-stage resections of affected bowel with primary anastomoses. Hinchey III and IV LPDs underwent either single-stage resections (7 patients or 31.8%), two-stage procedures (14 patients or 63.6%), or laparoscopic washout (1 patient or 4.5%).

There was no mortality in RPD and 1 mortality (4.5%) in LPD. Both RPD and LPD had similar length of inpatient stay (9.7 days in RPD and 10.8 days in LPD) and similar frequency of surgical complications (28.6% in RPD and 36.3% in LPD).

Discussion

The findings of our study suggest that right and left perforated diverticulitis (RPD and LPD) have different demographic predilections, Hinchey stage at presentation, and management outcomes. We found RPD patients to be younger than LPD patients (45.7 versus 58.3 years), and both RPD and LPD to have a similar predilection for males (1.75 males:1 female). Previous studies of mixed uncomplicated and complicated diverticulitis patients have reported similar results with regard to age and gender [10–12]. Chung et al. found left diverticulitis patients to be majority female, but this was not the case in our study [20].

Importantly in our cohort, RPD presented with lower Hinchey stage than LPD (85.7 versus 56.0% stage I or II), with no RPD patients presenting with fecal peritonitis (versus 10.0% of LPD). We are not aware of other studies directly comparing RPD and LPD, but one study by Law et al. looking only at diverticulitis patients who underwent emergency

surgery found that left-sided diverticulitis presented with more generalized peritonitis and greater morbidity and mortality [21]. Existing literature has also previously described a higher ratio of complicated to uncomplicated cases in left-sided compared to right-sided diverticulitis [10–12, 20, 22]. Our results when taken in the context of what others have found suggest that left diverticulitis may be a more aggressive disease than right diverticulitis. Left diverticulitis has a higher proportion of complicated diverticulitis and presents more severely with higher Hinchey stage than its right counterpart.

Conservative management of Hinchey I and II diverticulitis had similar success in both RPD and LPD, with few patients failing conservative therapy and requiring conversion to urgent surgery (3.1% in RPD and 3.5% in LPD). Compared to existing literature which has reported failure of conservative therapy in 7.9 and 11.9% of patients, our experience appears to be more favorable and supports the continued use of initial conservative therapy in Hinchey I and II diverticulitis as an alternative to emergent surgery [23, 24]. While some authors have advocated early elective surgery after initial conservative management of these patients citing lower recurrence rates and better patient-reported outcomes, our study found conservatively managed RPD patients to have much lower disease recurrence than LPD patients (3.1% in RPD and 17.9% in LPD) [25, 26]. While studies on RPD are scarce, several studies in western populations have found similarly high recurrence rates in LPD patients (24.0 to 41.2%) [27–29]. Our findings suggest that the role of early elective resections may be different in RPD and LPD, and it may be appropriate for clinicians to convey this difference between RPD and LPD to the patient when counseling on elective surgery.

Surgical therapy for Hinchey III and IV diverticulitis on the other hand appeared to be equally effective in both RPD and LPD cohorts. Both cohorts had similarly low mortality (0.0% in RPD and 4.5% in LPD), frequency of surgical complications (28.6% in RPD and 36.3% in LPD), and length of inpatient stay (9.7 days in RPD and 10.8 days in LPD). In our institution, RPD patients were treated with single-stage resections of affected bowel while LPD patients underwent a mixture of single-stage, two-stage, and laparoscopic washout procedures. The optimal surgical management of Hinchey III and IV diverticulitis remains controversial, with several recent studies advocating single-stage resections and laparoscopic peritoneal lavage over the traditional Hartman's procedure

Table 3 Hinchey I and II diverticulitis managed conservatively

	Right perforated diverticulitis (<i>n</i> = 32)	Left perforated diverticulitis (<i>n</i> = 28)	<i>p</i>
Failure of initial conservative management requiring surgery	1 (3.1%)	1 (3.5%)	0.924
Subsequent recurrence of disease	1 (3.1%)	5 (17.9%)	0.102
Length of inpatient stay (days)	4.6 ± 2.2	6.3 ± 3.8	0.043

[30–33]. We believe that more research is required in this area, particularly for RPD, as almost all research to date has been in western populations with majority LPD patients.

Finally, although RPD tended to present more localized disease and lower modified Hinchey stage, frequency of emergency surgery in RPD remained high in our cohort (34.7 versus 44.0% in LPD) due to frequent misdiagnoses as appendicitis. Ten of the 49 (20.4%) RPD patients were initially diagnosed with appendicitis and were treated surgically. All of these patients were subsequently found to have had modified Hinchey stage I or II disease and could have been managed conservatively. To differentiate between right-sided diverticulitis and appendicitis, some authors have suggested the use of particular clinical features such as lower leukocyte count and pain lateral to McBurney's point [34]. Lee et al. reported the use of a clinical scoring system in patients suspected to have either appendicitis or right colonic diverticulitis, achieving 85% sensitivity and 68% specificity [35]. Nonetheless, differentiating between the two remains a challenge, and more research is required to address this unique Asian clinical dilemma.

Limitations of our study include its retrospective design and selection of patients from a single institution. Although we are the first study to date comparing specifically right and left perforated diverticulitis and with balanced numbers in each group for meaningful comparison, because we included only patients with perforated diverticulitis, our cohort had relatively a low number of patients despite being a 10-year study. We did not collect patient-reported outcome measures such as quality of life scores or subjective complaints, which may have added to our evaluation of conservative therapy.

In conclusion, RPD tends to occur in younger patients and present less severely with fewer Hinchey III and no Hinchey IV diverticulitis. Conservative management of Hinchey I and II diverticulitis has high initial success in both RPD and LPD, although subsequent recurrence of disease is less common in RPD compared to LPD. As such, the role of elective resection in RPD appears to be limited in view of its low rate of recurrence (3.1%). Effort needs to be taken to reduce misdiagnoses of RPD as appendicitis, which leads to unnecessary surgery.

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