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The Management of Complicated Diverticulitis and the Role of Computed Tomography

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PURPOSE: Acute diverticulitis is a disease with a wide clinical spectrum, ranging from a phlegmon (stage Ia), to localized abscesses (stages Ib and II), to free perforation with purulent (stage III) or feculent peritonitis (stage IV). While there is little debate about the best treatment for mild episodes and/or very severe episodes, uncertainty persists about the optimal management for intermediate stages (Ib and II). The aim of our study was therefore to define the role of computed tomography (CT) and to analyze its impact on the management of acute diverticulitis.

METHODS: We retrospectively analyzed 511 patients (296 males, 215 females) admitted for acute diverticulitis between January 1994 and December 2003. Excluded were patients with stoma reversal only, "diverticulitis" mimicked by cancer, or significantly deficient patient records. Patients were analyzed either as a whole or subgrouped according to age ($<$40 yr, $>$40 yr). A modified Hinchey classification was used to stage the severity of acute diverticulitis.

RESULTS: In 99 patients (19.4%), an abscess was found (74 pericolic, 25 pelvic, median diameter: 4.0 cm). CT-guided drainage was performed in 16 patients, one failure requiring a two-stage operation. Whereas conservative treatment failed in 6.8% in patients without abscess or perforation, 22.2% of patients with an abscess required an urgent resection (68.2%, one-stage, 31.8%, two-stage). Recurrence rates were 13% for mild cases, as compared to 41.2% in patients with a pelvic abscess (stage II) treated conservatively with/without CT-guided drainage. Of all surgical cases, resection/primary anastomosis was achieved in 73.6% with perioperative mortality of 1.1% and leak rate was 2.1%.

CONCLUSIONS: CT evidence of a diverticular abscess has a prognostic impact as it correlates with a high risk of failure from nonoperative management regardless of the patient's age. After treatment of diverticulitis with CT evidence of an abscess, physicians should strongly consider elective surgery in order to prevent recurrent diverticulitis.

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INTRODUCTION

Left-sided diverticular disease of the colon has been associated with a Western lifestyle and an aging population (1). The incidence increases with age, varying from less than 10% in those younger than 40 yr of age to an estimated 50–60% of patients above 80 yr (2). The overwhelming majority of individuals with diverticulosis remain asymptomatic. Only an estimated 15–20% will develop diverticulitis (3–5), with an annual incidence of approximately 10 in 100,000 individuals (6), and 200,000 hospital admissions per year in the United States (1, 7).

Clinical manifestations of acute diverticulitis vary widely and range from mild phlegmonous changes to free perforation with feculent peritonitis. The diagnosis is suspected when the triad of lower abdominal pain, fever, and leukocytosis is present, either with absent, with local, or with generalized peritonitis. The Hinchey classification has traditionally been used to distinguish four stages of acute diverticulitis (8), based on clinical and operative findings (Table 1). With wide use of computed tomography (CT) that as the most sensitive tool has established itself as the imaging modality of choice (9, 10), several modifications of the Hinchey classification have been suggested in order to define new subcategories that take radiological findings into consideration (Table 1) (11).

The management of patients with acute diverticulitis is largely dictated by the stage of the disease at the time of presentation and by the observed response to the initiated treatment (1). While there is generally little doubt about the treatment for very mild cases on one hand (stages 0, Ia), and for very advanced cases on the other hand (stages III and IV),

Table 1. Hinchey Classification (8) and Modified Hinchey Classification of Acute Diverticulitis (Adapted from Wasvary (11))

Hinchey Classification		Modified Hinchey Classification		Comments
		0	Mild clinical diverticulitis	LLQ pain, elevated WBC, fever, no confirmation by imaging or surgery
I	Pericolic abscess or phlegmon	Ia	Confined pericolic inflammation—phlegmon	
		Ib	Confined pericolic abscess	
II	Pelvic, intraabdominal, or retroperitoneal abscess	II	Pelvic, distant intraabdominal, or retroperitoneal abscess	
III	Generalized purulent peritonitis	III	Generalized purulent peritonitis	No open communication with bowel lumen
IV	Generalized fecal peritonitis	IV	Fecal peritonitis	Free perforation, open communication with bowel lumen
		Fistula	Colo-vesical/-vaginal/-enteric/-cutaneous	
		Obstruction	Large and/or small bowel obstruction	

a general consensus has not been reached with regard to the stages in the middle of the spectrum (stages Ib and II). Lacking a sufficient knowledge of their natural and posttreatment course, these stages with evidence of complicated disease pose a therapeutic dilemma as to how to define the role and timing of radiological and surgical intervention. Many of today's radiological findings, in particular the presence, size, and location of abscesses, are incidental as they would have gone undetected in the past when CT was not routinely performed. The prognostic value of information resulting from such diagnostic tools will therefore need to be defined. Open controversies awaiting further clarification are whether a pericolic or pelvic abscess should or can be managed conservatively, whether an image-guided or surgical drainage should be attempted whenever possible or only at a certain abscess diameter, and whether a successful drainage should be considered a definitive or only a temporary (bridging) treatment until a definitive surgical resection is performed (12). Additional points of contention are the impact of the patients' comorbidities and age. The need to perform a prophylactic elective resection particularly in young patients with one resolved initial episode as prevention of further attacks (13) is becoming more controversial (14, 15).

In the current communication, we attempted to address some of these issues by reviewing all cases of acute diverticulitis at our institution within a 10-yr period. We selected to limit the study to the period after 1994 because by that year, the universal use of CT had evolved at our institution as the key diagnostic tool in the work-up of a majority of patients with suspected acute diverticulitis. The objectives of our analysis were (i) to define the impact of the CT finding of an abscess as evidence of complicated diverticulitis on the risk of failure of conservative treatment and of recurrent attacks, and (ii) to revisit the impact of the patient's age on the disease presentation and outcome.

MATERIALS AND METHODS

Patients

Patients who were treated for acute diverticulitis within the 10-yr period between January 1994 and December 2003 at the LAC/USC Medical Center were identified from the prospective departmental database[a] and included in the study. After identification of the patients, the full medical records were obtained and collectively reviewed by a group of six physicians who entered the data into a datasheet that had been generated with the software Epi Info 2002 (Atlanta, GA). Excluded were patients who were admitted primarily for stoma reversal after diverticular surgery, patients who in the hospital course were found to have a colon cancer that mimicked acute diverticulitis, or patients with relevant data deficiencies. Medical records were analyzed retrospectively and the following data were recorded: patients' demographics, symptoms, and duration of symptoms, past history of diverticulitis, comorbidity, previous abdominal surgery, clinical signs, white blood cells. Imaging results (abdominal series, CT) were reviewed with regard to free air, location, and extent of inflammation or an abscess, medical, interventional radiological, and surgical treatment, recovery course, complications, and follow-up. Acute diverticulitis was classified according to a modified Hinchey classification (Table 1 and Fig. 1), and the patients were analyzed either as the total patient collective, or as two separate age groups, that is, 40 yr of age or less, and above 40 yr of age. This cut-off point was chosen as the age of 40 has commonly been used to define a "young" patient group with diverticular disease that—solely based on their longer statistical life expectancy with thus increased lifetime risk for another potentially worse attack—was recommended to undergo a surgical resection. Surgical morbidity was defined as (i) directly related to the surgery (abdominal

[a]This limited database served as the department's continued workload documentation and included the patient's name and medical record number, the date of admission and discharge, the main admitting and discharge diagnosis (ICD-9 codes), and the performed surgical procedures (CPT codes). All data were entered by senior resident physicians and verified or corrected by the attending physicians during weekly staff conferences. While there is a high probability that the patients with acute diverticular disease were acurately and comprehensively recorded, there is a possibility that some patients with chronic sequelae of diverticulitis might have been recorded under their respective presentation, for example, large bowel obstruction (instead of "diverticulitis with stricture") or colo-vaginal/-vesical fistula (instead of "diverticulitis with fistula"). These chronic conditions might therefore be underrepresented but they were not the primary focus of the present study.

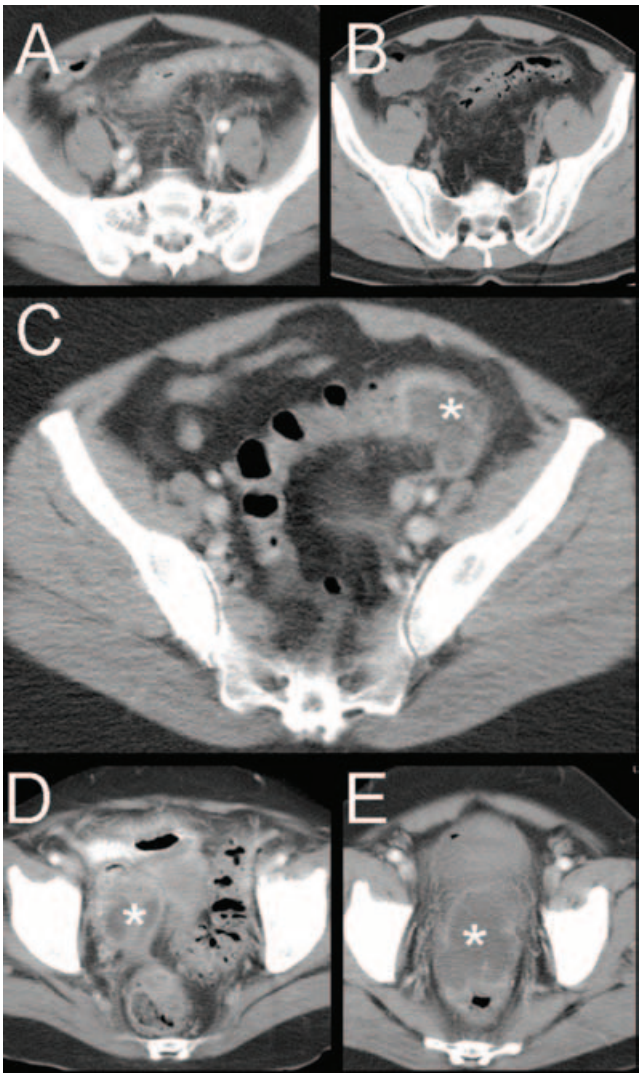

Figure 1. CT staging of acute diverticulitis (as described in text and Table 1). Pericolic phlegmonous inflammation with fat stranding, stage Ia (panels A and B). Confined pericolonic abscess (asterisk), stage Ib (panel C). Pelvic abscess (asterisks), stage II (panels C and D).

and wound infections, leaks, stoma complications, hernia formation) or (ii) general complications (cardiopulmonary, thromboembolic, urinary tract infections). Recurrences were defined as diverticulitis-like symptoms (left lower quadrant pain, fever, leukocytosis) occurring after normalization of symptoms and discharge from the index admission. The study protocol and data collection were approved by the Institutional Review Board of the University of Southern California and were consistent with HIPAA regulations.

Statistical Analysis

Results were reported in descriptive statistics using Epi Info 2002 software (Centers for Disease Control and Prevention, CDC) and expressed as mean ± standard deviation. Statistical analysis, using SPSS 12.0 for Windows software (SPSS Inc., Chicago, IL), was performed to compare the two age groups, using the χ^2 test or the Fisher's exact test for nominal variables, and the Student's *t*-test for continuous variables. Observed differences were considered statistically significant if $p < 0.05$.

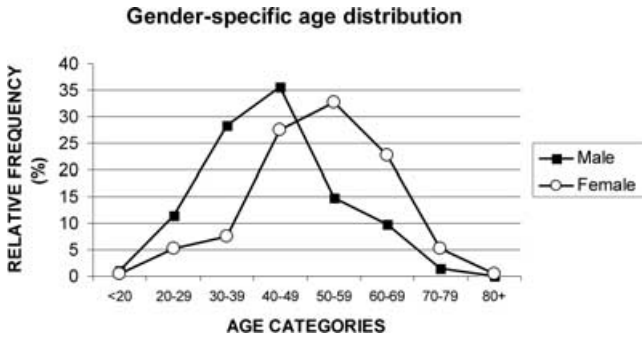

Figure 2. Gender-dependent age distribution showed two shifted curves with male patients predominating the young age group, female patients predominating in the 40+ group.

RESULTS

Data from 511 patients (296 males, 215 females) were included in the study analysis. Patient characteristics of the whole patient collective as well as of the two subgroups (<40 yr, >40 yr) are shown in Table 2. It is of note that the two genders showed a significantly different age distribution curve with male patients predominating the young age group, while female patients outnumbered male patients in the 40+ group (Fig. 2). The two age groups otherwise did not show any significant difference with one exception that the three comorbidities, arterial hypertension, diabetes, and use of steroids, were more frequent in the older age group. No difference was seen with regard to the patients' previous history of diverticulitis (Table 2) or their subjective symptoms at the time of presentation (data not shown). Follow-up data after discharge from the index admission were available in 342 patients with a mean follow-up of 46.5 ± 24.1 months (range: 14.3–96.6 months).

Stage Distribution and Treatment

Patients were categorized into the eight stages (outlined in Table 1) according to clinical, CT, or operative findings (Table 3). The two age groups did not show a significant difference in the stage distribution at the time of presentation. All patients were started on appropriate broad spectrum antibiotics to include coverage for gram-negative and anaerobic bacteria that are commonly part of colonogenic infections.

(i) Stages 0 and Ia: mild diverticulitis.
Three hundred and sixty-seven of 511 patients (71.8%) had diverticulitis without evidence for an abscess or perforation. In 98 patients, the diagnosis was purely clinical (stage 0), based on the classical triad of lower

Table 2. Patient Characteristics

	Total (n = 511)	<40 (n = 146)	40+ (n = 365)	*p*-Values
Age (yr)	46.9 ± 12.6			
Sex (male:female)	296/215	118/28	178/187	**<0.001**
WBC (×103/L)	13.9 ± 4.8	14 ± 4.5	13.7 ± 4.8	0.6
Previous history of diverticulitis	93	19.2% (28/146)	17.8% (65/365)	0.93
Comorbidities				
Diabetes mellitus	47	6/146 (4.11%)	41/365 (11.23%)	**0.02**
Hypertension	81	5/146 (3.42%)	76/365 (20.82%)	**<0.001**
Ischemic heart disease	13	2/146 (1.37%)	11/365 (3.01%)	0.45
COPD	7	1/146 (0.68%)	6/365 (1.64%)	0.68
Obesity	41	8/146 (5.48%)	33/365 (9.04%)	0.25
Cholelithiasis	22	2/146 (1.375)	20/365 (5.48%)	0.051
Steroid usage	11	0/146	11/365 (3.01%)	**0.04**

abdominal pain, fever, and leukocytosis. In 269 patients, the CT showed phlegmonous changes only (stage Ia). The majority of these patients responded well to antibiotics, irrespective of their age group. However, 6 (6.1%) and 19 (7.1%) patients, respectively, required a semi-urgent resection because of an inadequate response to conservative treatment (Table 4). Twenty-one patients were treated as a one-stage open operation with a primary anastomosis, only 4 patients required a two-stage approach. Three patients of stage 0 and 22 patients of stage Ia underwent an elective one-stage resection based on their age (<40 yr) or the fact of recurrent episodes of acute diverticulitis.

(ii) Stages III and IV: severe diverticulitis with perforation. Generalized peritonitis was present in 31 patients, 5 of whom had feculent peritonitis. CT of the abdomen and pelvis was performed in 16 of 31 patients, confirming the presence of peritoneal fluid and extraluminal air. All patients in these two categories underwent an urgent surgical resection (91% with a two-stage approach), 8 of them after an initial phase of antibiotic treatment.

(iii) Stages Ib and II: complicated diverticulitis with abscess. CT showed an abscess in 99 patients (19.4%). It was found in a pericolonic location in 74 patients (stage Ib) and in the pelvis in 25 patients (stage II, Table 4). The median maximal diameter of the abscess was 4.0 cm with a wide range of 1–24 cm.

In 16 patients (16.2%), the abscess was of sufficient size (mean 7.1 ± 1.9 cm) and in a favorable location to be considered amenable to drainage (Table 4). A percutaneous CT-guided drainage could be successfully placed in a single attempt (13 patients), in several attempts (2 patients), and failed in 1 patient. The latter patient required an emergency two-stage resection (Hartmann). Three patients who had a successful drainage procedure later underwent an elective (laparoscopic) resection with primary anastomosis a few months after the index admission. Of the remaining 12 patients, 5 patients (41.7%) developed a recurrent attack of acute diverticulitis (Table 5), which was phlegmonous in 2 patients (stage Ia), revealing another abscess in 2 patients (stages Ib and II), and resulting in a fistula in 1 patient. The fact of a recurrence and the clinical presentation were the indication for a surgical resection that was performed as a one-stage in 3 patients and as a two-stage with stoma in 2 patients. Paradoxically, the recurrence rate after CT-guided drainage in stage Ib was higher (40%) than in the respective overall stage group (12.7%), whereas the overall stage II group had an identical recurrence rate of 41.2%. It has to be noted, though, that the abscess diameter was significantly higher in the drained abscesses (6.5 ± 2.2 cm and 8.3 ± 0.6 cm in stages Ib and II, respectively) than in the undrained abscesses (3.6 ± 2.3 cm, $p < 0.001$).

In 66 patients with stage Ib and in 17 patients with stage II, the abscess was not amenable to CT-guided drainage. Antibiotic treatment remained the only treatment and was successful in resolving the acute episode of diverticulitis with regard to both clinical and biochemical parameters in 43 (58.1%) and 6 (24%) patients, respectively. In 14 (18.9%) patients with stage Ib and 8 (32%) patients with stage II, conservative treatment

Table 3. Distribution of Stages of Acute Diverticulitis

Stage	Total (n = 511)	<40 (n = 146)	40+ (n = 365)	*p*-Values	Age Average	Age Range
0	98	29	69	0.96	47.0	23–76
Ia	269	74	195	0.64	47.0	23–77
Ib	74	22	52	0.92	45.9	22–78
II	25	8	17	0.87	47.3	27–80
III	26	10	16	0.36	43.7	18–70
IV	5	1	4	0.99	50.2	32–73
Fistula	9	0	9	0.06	52.8	41–64
Obstruction	5	2	3	–	51.1	45–60

Table 4. Intervention for Acute Diverticulitis

Stages	CT-Guided Drainage	Immediate OR (One-Stage/Two-Stage)	Elective OR Post-Abx	Elective OR Post-CT Drainage	Total Number of Patients (%) Requiring Any Type of Intervention
0		6 (6/0)	3		9 (9.2)
Ia		19 (15/4)	22		41 (15.2)
Ib	8	14 (12/2)	9	1*	31 (41.9)
II	8	8 (3/5)	3	2*	19 (76.0)
III		19 (2/17)	7		26 (100)
IV		4 (0/4)	1		5 (100)
Fistula		5 (4/1)	4		9 (100)
Obstruction		5 (2/3)			5 (100)
Total	16	80	49	3	

OR = surgical resection; Abx = antibiotics.
*Only counted once (CT-guided drainage).

failed, and an urgent resection had to be performed during the same admission (Table 4). Fifteen (68.2%) of these patients could be performed as a one-stage operation with a primary anastomosis, 7 (31.8%) required a two-stage operation with creation of an ostomy.

Surgical Approach

The indication for an urgent surgical resection was based either on the patient's initial presentation (stages III and IV), on the lack of response within 72 h to or a clinical deterioration under the initial conservative treatment. An elective resection was offered to patients either with documented recurrences or who were below the age of 40. If the patient responded to antibiotic treatment, the presence of an abscess during the index admission was not yet considered an indication in itself for a surgical resection.

A total of 132 of 511 patients (25.8%) underwent a surgical resection, 96 (72.7%) of which were performed as one-stage resection with primary anastomosis. All 52 elective resections were carried out as a one-stage operation, increasingly and if feasible as a laparoscopically assisted procedure. Urgent surgeries were carried out on 80 patients (60.6%) (Table 4), all of which were open surgeries with a probability of 45.0% to end up with an ostomy. The stoma closure rate was 63.6%, and the mean closure time was 6.6 months after primary operation.

Morbidity and Mortality

More severe forms of diverticulitis increased the risk to suffer a complication. While morbidity and mortality in stages 0 and I a were low at 4.4% and 0%, respectively, patients with stages Ib and higher were significantly more frequently affected with 32.3% complications and 2.3% fatal outcome (3 patients), respectively. Surgical complications (n = 58) included anastomotic leakage (n = 2, *i.e.*, 2.1% of all primary anastomoses), intraabdominal abscess (n = 6), cardiopulmonary complications (n = 9), stoma necrosis (n = 2), urinary tract infection (n = 4), wound infection (n = 17), wound dehiscence (n = 5), and incisional hernia (n = 1).

Recurrence Rate

Recurrences were defined as any diverticulitis-like symptoms (left lower quadrant pain, fever, leukocytosis) with associated clinical, biochemical, or radiological parameters occurring after normalization of symptoms and discharge from the index admission. Table 5 shows a correlation of the diverticulitis stage with the incidence of a recurrent attack and the overall success of a conservative management in avoiding a surgical resection either during the index admission or within the follow-up period. The recorded overall recurrence rate in 342 patients with available follow-up data was 18.1%, and the mean interval to the onset of the recurrence was 4.7 ± 5.9 months (range: 0.5–28 months). Even mild

Table 5. Stage-Dependent Recurrence and Success of Nonresective Management

Stages	N Total	N Available for Follow-Up	Recurrence During Follow-Up (%)	Overall Chance of Group to Avoid Resective Surgery (%)
0	98	51	11 (21.6)	89 (90.8)
Ia	269	194	36 (18.6)	228 (84.8)
Ib (overall)	74	55	7 (12.7)	50 (67.6)
with CT-drainage	8	5	2 (40.0)	4 (50.0)
II (overall)	25	17	7 (41.2)	12 (48.0)
with CT-drainage	8	7	3 (42.8)	3 (37.5)
III	26	20	2 (10.0)	0 (0)
IV	5	3	0	0 (0)
Fistula	9	2	0	0 (0)
Obstruction	5	na	na	0 (0)
Total	511	342	63 (18.4)	379 (74.2)

cases of diverticulitis (0, Ia) treated conservatively had a recurrence rate of 13% overall or 19.2% of the patients with documented follow-up. The highest recurrence rates were noted in patients with stage II diverticulitis (41.2% of all patients, 53.8% of all not previously operated patients). Patients with stage III and IV had lower recurrence rates of 10 and 0%, respectively, reflecting the fact that all patients had undergone a surgical resection. No difference was noted between the two different age groups, that is, the younger patients had roughly the same risk for a recurrent attack as the older patient group.

DISCUSSION

Acute left-sided diverticulitis is a complication evolving from colonic diverticula, which starts with a microperforation, may progress to several different clinical pictures and result in death, and which has a tendency to recur. The patient management has to focus on the immediate attack as well as on the prevention of future episodes. It therefore depends on a multitude of factors including the patient's overall clinical presentation and condition, the extent of the disease, underlying comorbidities, and a history of previous attacks (16, 17).

Contrast enemas, abdominal x-rays, and abdominal ultrasound, the primary diagnostic tools in the past, have moved to the background as they are less sensitive in assessing the pericolic inflammation and distant pathology (12). Instead, CT has evolved as the standard diagnostic test for suspected diverticulitis (9, 10, 18), because it is rapid, widely available, reproducible, and very sensitive (12). However, CT provides us with details, in particular the presence, size, and location of abscesses, which were not appreciated in the past. Some of these hidden pathologies likely responded to empirical conservative treatment while others did not and were then recognized during a surgical exploration for failure. It is therefore of importance to establish prognostic criteria for CT findings and to obtain further clarification with regard to their impact on the management.

Our current retrospective review that involves 511 patients over a 10-yr period is one of the largest series in the literature and therefore well suited to address these issues. Even though a far larger number of patients could have been included in our analysis, we chose not to extend the study period to the years before 1994 in order to assure a comparable standard of care with universal availability and use of CT in the work-up of patients with suspected diverticulitis. The original Hinchey classification (8) was the first attempt to stratify patients with acute diverticulitis into different severity categories, but the system is not detailed enough to reflect the presence and location of an abscess. We therefore used a new classification that was expanding on a previous adaptation (11) of the Hinchey categories by introducing three additional groups: stage 0, fistula, obstruction (as shown in Table 1).

Our results are consistent with the literature as the majority of patients (70%) have relatively mild forms of acute diverticulitis and with few exceptions (6.8%) responded well to conservative treatment. Our data also demonstrate that modern management of even very severe forms of diverticulitis can achieve good outcome with a minimal mortality rate (2.3%) and acceptable complication rates of 11.7% (stage-dependent range: 4–32%).

The most important findings of our analysis, however, are the data on patients found on CT scan to have an abdominal or pelvic abscess (stages Ib and II). We confirm reports in the literature that CT-guided drainage of an amenable pericolic or pelvic abscess can be safely performed and is successful in 93% (19–22). The incentive for a temporizing palliation, as opposed to an immediate surgical exploration, lays in the reduction of the abdomino-pelvic inflammation; this should allow a safer resection and clear the area for a primary pelvic anastomosis without diversion.

Based on our size comparison of the drainable and the nondrainable abscesses, we suggest—like other authors (1)—that an attempt should be undertaken for abscesses that are 5 cm or more in maximal diameter. Success in this setting with a risk of potentially major sepsis should be interpreted very cautiously and solely as the ability to avert an emergency situation and convert it into an urgent or elective one (23). Of 16 patients with attempted CT-guided drainage, only 1 (6.3%) failed and required a two-stage operation, as compared to 31.8% in the whole group (stages Ib and II). This supports the concept that CT-guided drainage—if amenable—truly provides a tool to lessen the risk of an immediate operation with the potential for an ostomy. Even though it might be tempting in an individual case that is cooling off after drain placement to continue conservative management without surgery, such an approach has to accept a potentially worse outcome. Unless a (semi)elective, commonly single-stage resection is being performed, there is a significant risk of up to 42% to develop a recurrent diverticulitis episode and an increased probability (40%) to end up with an ostomy as compared to 0% in all elective procedures. This number translates into a significant impact on the quality of life as only 63% of these patients eventually have their ostomy taken down. Contrasting a speculative concept that surgical resection may not be mandatory in every case after successful percutaneous drainage (16), our data therefore do not support such a view but strongly indicate that even a successful drainage should not be considered a definitive treatment but only a temporary bridge until a definitive surgical resection is performed.

Even though successful percutaneous drainage of an abscess resulted in rapid resolution of signs of sepsis, the recurrence rate seemed to be higher than in 83 patients with an abscess who did not undergo drainage. One of the pathophysiological explanations for this paradox relates to the fact that the drained abscesses were significantly larger in size than the ones that were not amenable to drainage. Given that

an abscess results from a concealed macroperforation that is unlikely to spontaneously seal off, a location distant from its origin and a larger size represent a less favorable disease and thus result in a higher recurrence.

Several aspects of the history and pathophysiology cannot be answered with our current study and will require further investigations. For one, it remains unclear which patients, without evidence for an abscess, will fail conservative treatment. It cannot be ruled out that differences in the antibiotic regimens could have had an impact. From a diagnostic standpoint, however, additional radiological data, potentially a combination of tests, will be needed to better characterize these subcategories. On the other end of the spectrum, we will have to learn which patients with an abscess will do well without intervention.

Another aspect of our present study has a significant impact and merits further discussion. The patient population seeking medical care at our institution showed a Hispanic preponderance (74.7%) and, with an average age of 46.9 yr and 29% being less than 40 yr old, was much younger than reported in other series. This gave us the opportunity to reassess the notion that diverticulitis in younger patients has a higher virulence (24, 25). Subset analysis of our patients with regard to their age (<40 yr, >40 yr) could not detect any significant difference in the patients' clinical presentation, stage, and outcome, a finding that again challenges the view of a more aggressive form of the disease in younger patients. The recommendation to perform a prophylactic elective resection in these young patients with one resolved initial episode as prevention of further attacks should therefore solely be based on their longer residual life span.

In conclusion, we report that the CT finding of an abscess is a relevant prognostic sign of complicated diverticulitis as it correlates with a high risk of recurrent attacks, irrespective of the patient's age. Based on our retrospective data, we therefore suggest that CT-guided drainage of an abscess may serve as a temporizing measure, but that after treatment of diverticulitis with evidence of an abscess, physicians should strongly consider elective surgery in order to prevent recurrent diverticulitis.

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