Int J Colorectal Dis (1999) 14:250–254

ORIGINAL ARTICLE

Y. Reisman · Y. Ziv · D. Kravrovitc · M. Negri
Y. Wolloch · A. Halevy

Diverticulitis: the effect of age and location on the course of disease

Accepted: 21 June 1999

Abstract To examine the effect of patient's age and the location of diverticular disease on the course of the acute disease we retrospectively collected demographic data, symptoms, laboratory findings, imaging techniques, type of treatment (conservative vs. surgical), early and late complications, and follow-up data on 119 patients with acute diverticulitis (74 women, 45 men; mean age 64±14 years; follow-up 7–102 months, median 40). Patients were divided by their age into two groups (42 aged 60 years or younger, 77 aged over 60) and on the location of their disease (108 to the left of the middle transverse, 11 to the right). Lower abdominal pain, abdominal tenderness, and fever were the most common complaints (70–97%). In the younger patients we found a significantly greater preponderance in the right colon (P=0.02) than in older patients. Abdominal abscesses and fistulas were more common in right-sided diverticulitis (P=0.01). Patients with right-sided colon diverticulitis were treated surgically (82%) and on an emergency basis more often than patients with left-side colon diverticulitis (25%; P=0.001). Older patients treated conservatively suffered more than younger patients (61% and 33% respectively; P=0.04) from recurrent abdominal pain but not from recurrent, confirmed diverticulitis. Patients with right-sided diverticulitis treated conservatively suffered more from recurrent diverticulitis episodes than patients with left-sided diverticulitis (P=0.05). Younger patients thus do not have a more aggressive form of diverticulitis than older patients. Patients with acute diverticulitis in the right colon are likely to be operated earlier and for mistaken diagnoses than patients with left-sided diverticulitis.

Key words Diverticulitis · Age · Location

Y. Reisman · Y. Ziv · M. Negri · A. Halevy
Department of Surgery, Assaf Harofeh Medical Center,
Tel-Aviv University, Tel-Aviv, Israel

Y. Reisman (✉)
Department of Urology, Academic Medical Center,
Meibergdreef 9, 1105 AZ Amsterdam Zuidoost, The Netherlands
e-mail: creisman@hotmail.com,
Tel.: +31-20-5669111, Fax: +31-20-6438407

D. Kravrovitc · Y. Wolloch
Department of Surgery, Rabin Medical Center, Campus Golda,
Tel-Aviv University, Tel-Aviv, Israel

Introduction

Diverticular disease of the colon usually occurs in the left side of the colon, with right-sided disease accounting for less than 5% of colon diverticulosis [1]. Presentation and management of left-sided diverticulitis differ from those of right-sided diverticulitis. The incidence of acute diverticulitis increases with the duration of diverticulosis from 10% after 5 years to 35% after 20 years [2] and is considered to be a disease particularly of elderly patients, who rarely present before the age of 40 years [3]. Acute diverticulitis in young patients accounts for 2–5% of all such episodes and may follow a more aggressive course with a higher incidence of complications than in older patients [4–8]. Still, the management of acute diverticulitis and timing of surgical intervention in young patients remains controversial [8–10]. The purpose of this study was to evaluate the effect of age and location of the diverticular process on the course and severity of diverticulitis.

Patients and methods

Data from the medical files of 122 patients treated for acute diverticulitis, confirmed by computed tomography, ultrasonography, X-ray, or colonoscopy between 1987 and 1997 were collected retrospectively in two surgical departments affiliated with Tel Aviv University, Israel. Complete data were available on 119 (74 women, 45 men; mean age at the time of diagnosis 64.2±1.5 years). Demographic data, symptoms and signs, laboratory findings, imaging techniques, type of treatment (conservative vs. surgical), early (within 30 days of diagnosis) and late complications and follow-up information were recorded. Follow-up data were recorded from patient files and through telephone call inquiry. The median duration of their symptoms was 3 days (range 1–30), and the mean white blood cell count was 12.4±4.3. The most common com-

Table 1 Symptoms and signs in 119 patients with acute diverticulitis according to location of acute diverticulitis and age groups

	Location							Age				
	Total (*n*=119)		Left colon (*n*=108)		Right colon (*n*=11)		*P*[a]	≤60 years (*n*=42)		>60 years (*n*=77)		*P*[a]
	n	%	*n*	%	*n*	%		*n*	%	*n*	%	
Nausea	57	48	50	46	7	64	NS	17	40	40	52	NS
Vomiting	27	23	24	22	3	27	NS	7	17	20	26	NS
Fever	83	70	77	71	6	55	NS	27	64	56	73	NS
Chills	11	9	10	9	1	9	NS	1	2	10	13	0.05
Diarrhea	25	21	21	19	4	36	NS	7	17	18	23	NS
Constipation	53	44	50	46	3	27	NS	18	43	35	45	NS
Feeding												
Normal	106	89	95	88	11	100	NS	40	95	66	86	NS
High fiber	7	5	7	6	0		NS	2	5	5	6	NS
Low fiber	6	6	6	5	0		NS	0		6	8	NS
Obese	30	25	25	23	5	45	NS	9	21	21	27	NS
Weight loss	49	41	45	42	4	36	NS	13	31	36	47	NS
Pain												
Right lower quadrant	10	8		0	10	91	0.001	8	19	2	2	NS
Left lower quadrant	77	65	77	71	0		0.001	24	57	53	69	NS
Diffuse	11	9	10	9	1	9	NS	5	12	6	8	NS
Other	19	16	19	18	0		NS	11	26	8	10	NS
Abdominal distention	52	44	47	43	5	43	NS	10	24	42	56	0.001
Bowel sound												
Normal	106	89	95	88	11	100	NS	40	95	66	86	NS
Increased	6	5	6	6	0		NS	2	5	4	6	NS
Decreased	7	6	7	6	0		NS	0		7	9	NS
Abdominal tenderness	116	97	105	97	11	100	NS	42	100	74	96	NS
Abdominal resistance	58	49	49	82	9	45	0.03	21	50	37	48	NS
Rebound	39	33	32	30	7	63	0.04	18	43	21	27	NS

[a]Mann-Whitney test

plaints were abdominal pain, localized tenderness, and fever (in 70–97%; Table 1).

Patients were divided into two groups depending on their age; 42 were aged 60 years or younger and 77 were aged over 60. Patients were also divided based on the location of disease; in 108 it was to the left of the middle transverse, and in 11 it was to the right.

Recurrent abdominal pain was defined as an episode with at least one visit to the emergency room but without evidence of acute diverticulitis (no high fever, raised white blood cell count, or suspicion by ultrasonography and/or computed tomography). Conservative treatment included bowel rest, parenteral fluids and antibiotics (ampicillin, metronidazole, and gentamycin) for at least 5 days. Ultrasonography was performed in 73 patients (61%) and was diagnostic in 22%; computed tomography was carried out in 57 patients (48%) and was diagnostic in 86% (P=0.01). In 26 patients both imaging techniques were used because one had proven nondiagnostic.

Statistical analysis was carried out with Systat program using Student's *t* test for nominal distributed parameters and the Mann-Whitney test and Fisher's exact test for nonnominal data.

Results

Demographic data, duration of symptoms, white blood cell, complications and mode of treatment are presented in Table 2. At admission 53 complications related to the inflammatory process were present in 36 of the 119 patients (30%). Lower gastrointestinal bleeding was present in ten patients, eight of them in group B. All were treated conservatively with packed red blood cell transfusion. All other complications were treated surgically.

Of the 119 patients 83 (70%) were treated conservatively by bowel rest, intravenous antibiotics, repeated physical examination, blood analysis for complete blood count, and electrolytes. Ultrasonography or computed tomography were repeated as needed. Of these 83 patients 10 (12%) were operated on 3–6 months later with resection and primary anastomosis, 36 were operated on at the first admission with acute diverticulitis or its complications, 18 had resection and primary anastomosis, 11 had Hartmann's procedure, and 7 were treated by exploratory laparotomy and drainage of intra-abdominal abscess. There was no postoperative mortality. The morbidity rate was 25% (n=9); two patients with intra-abdominal bleeding which required relaparotomy; and one patient with sepsis and six with postoperative wound infection were treated conservatively.

More patients in the older group had a previous history of hypertension, ischemic heart disease, and chronic obstructive lung disease than those in the younger group (P=0.02). Acute diverticulitis was equally distributed between men and women in the younger group, but there was a 1:2 male-to-female ratio in the older group (P=0.02).

Of the 11 patients with right-sided diverticulitis (9%) nine (82%) were diagnosed only during surgery for suspected acute appendicitis. Table 3 compares patients with left-sided and those patients with right-sided diverticulitis. There were more complications, at the time of

Table 2 Characteristics of 119 patients with acute diverticulitis

	Total (*n*=119)	Age ≤60 years (*n*=42)	Age >60 years (*n*=77)	*P*[a]
Age (years)	64±14	48±8	73±8	
Sex (men, women)	45, 74	22, 20	23, 54	0.02
Duration of symptoms (median, range; days)	3, 1–30	3, 1–30	2, 1–30	NS
White blood cells ($\times 10^3$/l)	12±4	13±4	11±4	0.04
Imaging technique				
Ultrasonography	73 (61%)	22 (52%)	51 (66%)	NS
Computed tomography	57 (48%)	21 (50%)	36 (47%)	NS
Both	26 (22%)	7 (17%)	19 (24%)	NS
Complications				
Patients	36 (30%)	12 (28%)	24 (31%)	NS
Abscess	26 (22%)	9 (21%)	17 (22%)	NS
Fistula	6 (5%)	1 (2%)	5 (6%)	NS
Bleeding	10 (8%)	2 (5%)	8 (10%)	NS
Perforation	11 (9%)	3 (7%)	8 (10%)	NS
Colon location				
Right, left	11, 108	8, 34	3, 74	0.02
Treatment				
Conservative	83 (70%)	27 (64%)	56 (73%)	NS
Emergency surgery	36 (30%)	15 (36%)	21 (27%)	NS
Elective surgery	10 (12%)	3 (11%)	7 (12%)	NS
Hospital stay (days)				
Conservative treatment	6±3	6±1	6±4	NS
Surgical treatment	14±8	13±7	15±9	NS

[a]Mann-Whitney test and Fisher's exact test

Table 3 Characteristics and differences between patients with acute diverticulitis of the right side colon versus left side colon

Item	Right colon diverticulitis (*n*=11)	Left colon diverticulitis (*n*=108)	*P*[a]
Age (years)	55±15	65±14	0.04
Sex (men, women)	4, 7	41, 67	NS
Duration of symptoms (median, range; days)	2, 1–21	3, 1–30	NS
White blood cells ($\times 10^9$/l)	12±3	12±4	NS
Imaging techniques			
Ultrasonography	7 (63%)	66 (61%)	NS
Computed tomography	4 (36%)	53 (49%)	NS
Both	3 (27%)	23 (21%)	NS
Complications			
Patients	6 (55%)	30 (28%)	0.02
Fistula	2 (18%)	4 (4%)	0.05
Abdominal abscess	6 (55%)	20 (19%)	0.01
Bleeding	0 (0%)	10 (9%)	0.05
Perforation	1 (9%)	10 (9%)	NS
Treatment			
Conservative	2 (18%)	81 (75%)	0.02
Emergency surgery	9 (82%)	27 (25%)	0.01
Elective surgery	0 (0%)	10 (12%)	0.05
Hospital stay (days)			
Conservative treatment	8±1	6±3	NS
Surgical treatment	9±2	15±9	0.03

[a]Mann-Whitney test and Fisher's exact test

admission in patients with diverticulitis of the right colon than in those with diverticulitis of the left colon (*P*=0.02). Enteroenteric fistula (*P*=0.05) and abdominal abscesses (*P*=0.01) were more common in patients with right-sided diverticulitis, while perforation was equally distributed in patients with left- or right-sided diverticulitis. Lower gastrointestinal bleeding was more common (*P*=0.05) in patients with left-sided diverticulitis.

Eight patients with right-sided diverticulitis had resection and primary anastomosis, one had exploratory laparotomy and drainage of diverticular abscess, and two were treated conservatively. Of the 108 patients with left-sided diverticulitis 27 (25%) were treated surgically because of deterioration in their clinical state; 11 underwent Hartmann's procedure, 10 resection and anastomosis, and 6 exploration and drainage of an intra-abdominal abscess. In 26 (91%) the diagnosis was made preoperatively. The postoperative morbidity rate was 12% (*n*=1) in right-sided diverticulitis and 29% (*n*=8) in left-sided diverticulitis (*P*>0.05).

During a median follow-up of 40 months (range 7–102), 5 of the 77 older patients (6.5%) developed co-

Table 4 Follow-up of 119 patients diagnosed with acute diverticulitis (median 40 months, range 7–105) according to the type of treatment, age, and location of diverticulitis in the colon (*Cons*. conservative treatment, *Surg*. surgical treatment)

	Age								Location							
	≤60 years (*n*=42)				>60 years (*n*=77)				Right colon (*n*=11)				Left colon (*n*=108)			
	Cons. (*n*=27)		Surg. (*n*=15)		Cons. (*n*=56)		Surg. (*n*=21)		Cons. (*n*=2)		Surg. (*n*=9)		Cons. (*n*=81)		Surg. (*n*=27)	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Recurrent abdominal pain	8	29*	9	60	30	53*	19	90	0	–	6	67	38	50	22	81
Recurrent diverticulitis	8	30	5	33	18	32	8	38	2	100*	0	–	24	30*	13	48
Elective surgery	3	11	0	–	7	12	0	–	0	–	0	–	10	12	0	–

*P=0.04–0.05, Mann-Whitney test

lon cancer, and two of these died. The five patients had had the diverticular inflammatory process 3-8 years before colon cancer was diagnosed. Older patients who were treated conservatively for acute diverticulitis suffered from more episodes of recurrent abdominal pain than younger patients (P=0.05) during the follow-up. No significant difference was found in recurrent abdominal pain between surgically treated patients for acute diverticulitis in the older and the younger groups (Table 4).

Recurrent diverticulitis occurred in 39 patients (26 treated conservatively and 13 treated surgically for the first episode of diverticulitis), 10 of whom were operated on electively 3–6 months after the second episode of diverticulitis. In 26 of the 36 patients with recurrent diverticulitis (66%) the first episode of recurrent diverticulitis appeared 2–6 months after the diagnosis of acute diverticulitis and in 32 patients (82%) less than 1 year after the diagnosis. Five patients refused any elective surgical intervention and 24 were at high risk for surgery or had a mild form (Hinchey I) of recurrent diverticulitis. No significant difference in recurrent diverticulitis was found between older and younger patients, whether they were treated conservatively or surgically in the first episodes of diverticulitis.

More patients treated conservatively for left-sided diverticulitis suffered from recurrent abdominal pain (P=0.05). No significant association was found between the incidence of recurrent abdominal pain or diverticulitis and the location of disease in patients treated surgically in the first episode of acute diverticulitis. Among those treated conservatively patients with right-sided diverticulitis suffered more from recurrent diverticulitis than those with left-sided diverticulitis (P=0.04).

Discussion

Diverticulosis, and acute diverticulitis, is usually associated with old age [3]. Young patients also often seem to have a more virulent course of the disease. The definition of young age is subjective, and definitions of young age differ in comparing the treatment of acute diverticulitis in young persons with that in the elderly. The studies of Vignati et al. [8], Ambrosetti et al. [9] use a cutoff of 50 years while that of Spivak et al. [11] use one of 45 years. We differentiated between those over or under 60 years of age, as we have found more comorbidity and high-risk factors from the seventh decade and above.

We discovered no significant differences in relation to duration of symptoms, presentation at admission with complicated diverticulitis, mode of treatment, or hospital stay, although more patients in the older group had concomitant atherosclerotic heart disease, chronic obstructive lung disease, hypertension, and diabetes mellitus (P<0.02). There were, however, more patients with right-sided diverticulitis in the young group (20%) than in the older group (4%; P=0.02). This may have been due in part to mistaken diagnoses of acute diverticulitis.

Ambrosetti et al. [9] reported that young patients are more prone to recurrences and complications after conservative treatment of diverticulitis. These patients also refused operation significantly more often during their first admission. We found no difference in the incidence of confirmed recurrent diverticulitis in younger and older patients who were treated conservatively (29% vs. 32%, respectively) or surgically (33% vs. 38%) during their first admission for acute diverticulitis. More older patients suffered from recurrent abdominal pain (53% vs. 29%) when treated conservatively, but not surgically at their first admission for acute diverticulitis. There was no difference between the two groups in the need for emergency operation, in contrast to the findings of Ambrosetti et al. [9]. The need for emergency surgery in our series was 30%, which is higher than that in Ambrosetti's [9] series (15%), but the same as in that of Spivak et al. [11] (35%) and less than the 55% reported by Konvolinka [12]. As expected, in most of our younger patients with right-sided diverticulitis the diagnosis was made during surgery, as has also been reported by others [10–13]. The most common mistaken diagnosis was acute appendicitis. An accurate diagnosis is not always made during surgery, and a contrast enema study is needed to verify the presence of diverticulum [14].

Ultrasonography was diagnostic in only 22% of cases, compared to the 86% diagnostic accuracy of computed tomography. These figures are in accordance with those of other reports [6, 15–16] and demonstrate the lack of usefulness of ultrasonography in diagnosing diverticular disease, particularly in those with acute disease and low incidence of diverticular abscess formation. Due to the the unsatisfactory diagnostic rate of ultrasonography, computed tomography has become the preferred diagnostic method. In our study ultrasonography was first performed routinely in one of the two participating departments.

In only 9% of our patients was the acute diverticulitis located in the right colon, which is in accordance with the incidence in reported by other studies in Western countries [1, 3] and contrasts to the data from the Far East, with up to 76% of diverticulosis located in the right colon [13].

Patients with right-sided acute diverticulitis presented at admission with more complications (P=0.02) than those with left-sided diverticulitis, although there was no significant difference in duration and type of symptoms or white blood cell count and only slight difference in their signs. It is difficult to compare the natural history of acute diverticulitis affecting the right side with that of the left side of the colon because of the small number of patients with right-sided diverticulitis in our series. Still, the only two patients treated conservatively for right-sided diverticulitis suffered from recurrent diverticulitis, compared to 30% of those treated conservatively for left-sided diverticulitis.

Parks [3] found that only 25% of 317 patients with conservatively treated acute diverticulitis were readmitted with a second attack. Our findings are similar, with an incidence of 31% recurrent diverticulitis in 83 patients treated conservatively. Although there is a high incidence of recurrent symptoms in patients treated conservatively for acute diverticulitis, the majority of patients still do not require surgery regardless of whether they are younger or older than 60 years old, and whether it is located in the right or left side of the colon. We agree with Spivak et al. [11] that the recommendation for routine elective resection following the first episode of diverticulitis should be reassessed.

References

1. Hughes LE (1969) Postmortem survey of diverticular disease of the colon. Gut 10:336–351
2. Horner JL (1958) Natural history of diverticulosis of the colon. Am J Dig Dis 3:343–50
3. Parks TG (1975) Natural history of diverticular disease of the colon. Clin Gastroenterol 4:53
4. Mader TJ (1994) Acute diverticulitis in young adults. J Emerg Med 12:779–782
5. Ouriel K, Schwartz S (1983) Diverticular disease in the young patients. Surg Gynecol Obstet 156:1–5
6. Kin U, Dreiling D (1974) Problems in the diagnosis of diverticulitis in the young. Am J Gastroenterol 62:109–115
7. Freischleg J, Bennion R, Thompson J (1986) Complications of diverticular disease of the colon in young people. Dis Colon Rectum 29:639–643
8. Vignati PV, Welch JP, Cohen JL (1995) Long-term management of diverticulitis in young patients. Dis Colon Rectum 38: 627–629
9. Ambrosetti P, Robert JH, Witzig JA, Mirescu D, Mathey P, Borst F, Rohner A (1994) Acute left colonic diverticulitis: a prospective analysis of 226 consecutive cases. Surgery 115: 546–550
10. Anderson DN, Driver CP, Davidson AI, Keenan RA (1997) Diverticular disease in patients under 50 years of age. J R Coll Surg Edinb 42:102–104
11. Spivak H, Weinrauch S, Harjey JC, Swuck B, Ferstenberg H, Friedman I (1997) Acute colonic diverticulitis in the young. Dis Colon Rectum 40:570–574
12. Konvolinka CW (1994) Acute diverticulitis under age forty. Am J Surg 107:562–565
13. Markham NI, Li AKC (1992) Diverticulitis of the right colon – experience from Hong-Kong. Gut 33:547–549
14. Graham SM, Ballantyne GH (1987) Caecal diverticulitis. A review of the American experience. Dis Colon Rectum 30: 821–826
15. Oudenhoven LF, Koumans RK, Puylaert JB (1998) Right colonic diverticulitis: US and CT findings – new insights about frequency and natural history. Radiology 208:611–6118
16. Yacoe ME, Jeffrey RB Jr (1994) Sonography of appendicitis and diverticulitis. Radiol Clin North Am 32:899–912