# Usefulness of Colonic Motility Study in Identifying Patients at Risk for Complicated Diverticular Disease

C. Cortesini, Professor of Surgery, Head of Clinica Chirurgica 3, D. Pantalone, M.D., Assistant of Clinica Chirurgica 3

From the Clinica Chirurgica 3, Universitá di Firenze, Firenze, Italy

Cortesini C, Pantalone D. Usefulness of colonic motility study in identifying patients at risk for complicated diverticular disease. Dis Colon Rectum 1991;34:339–342.

Colonic motility study was performed on a total of 145 patients. Of these, 55 were patients with symptomatic complicated diverticular disease, 30 had symptomatic uncomplicated diverticular disease, 30 had asymptomatic diverticular disease, and 30 were controls. The pressure sensors were positioned in the descending and the true sigmoid colon. Colonic motility index was significantly higher in symptomatic rather than in asymptomatic diverticular disease in the resting (P < 0.001) and postprandial (P < 0.001) states. This confirmed the association between symptomatic diverticular disease and high intraluminal pressure. The patients of the subgroup-complicated diverticular disease-were relatively young (mean age: 51.1  $\pm$  2.02 years) and had a short history of abdominal pain (18-36 months) and a short segment of colon with diverticula (cm 7.25  $\pm$  1.31). Our observations suggest that patients showing these indicators are at risk for major complication. [Key words: Diverticular disease; Colonic motility; Anterior resection of the rectum]

D iverticulosis of the colon is an increasingly common condition in western economically developed countries. It seems to be correlated with aging and a low-fiber diet. From a pathogenetic point of view, the formation of diverticula involves a pressure gradient between the colonic lumen and serosa and areas of weakness in the colonic wall.

Recently, serious questions have been raised about whether increased intraluminal pressure is a consistent factor in the cause of diverticular disease. Almost all patients with asymptomatic diverticular disease (ADD) have a normal motility index. However, a high percentage of patients with symptomatic (SUDD) or complicated diverticular disease (SCDD) show an overactive sigmoid colon. (Terminology is defined in Table 1.)

Even if there is general agreement on the nontreatment of ADD and on the surgical treatment of SCDD, some controversy remains about the future of patients with SUDD. Can the colonic motility study identify the patients at risk in this group for complicated diverticular disease? With this aim in mind, a study was performed on a group of patients who had undergone emergency surgery for complicated diverticular disease of the colon.

#### **METHODS**

Colonic motility was studied in a total of 145 patients. Of these 55 were patients with SCDD, 30 were patients with SUDD, 30 were patients with ADD, and 30 were healthy volunteers (control subjects). The control subjects had normal bowel habits with no disorders of the colon or rectum and no abdominal complaints. The SCDD, SUDD, and control groups were matched for age and sex. The mean age of patients with ADD was higher.

We classified the patients in whom diverticular disease was an incidental finding as the ADD group. These patients had normal bowel habits (only 12 of them reported slight constipation) and no abdominal discomfort. We classified the patients with recurrent attacks of left lower quadrant abdominal pain, no fever, no leukocytosis, and no elevated erythrocyte sedimentation rate as the SUDD group.

Of the 55 patients with SCDD, four had a colovescical fistula, two a colocolonic fistula, and six a moderate bowel obstruction; the remaining 43 patients had peridiverticulitis (two of them had had moderate hemorrhagic episodes). All 55 patients underwent semielective surgery. The operation of choice was anterior resection of the rectum (with wide resection of the descending colon and preservation of the inferior mesenteric artery).

Two days before examination the subjects were given a low-residue diet. A light bowel cleansing was performed 24 hours previously. Two openended catheters (intraluminal diameter 1.5 mm)

This study was supported by M.P.I. grants.

Address reprint requests to Professor Cortesini: Clinica Chirurgica 3, Universitá di Firenze, Careggi 50134 Firenze, Italy.

 Table 1.

 Nomenclature of Diverticular Disease of the Colon

Disease	Description
Asymptomatic diverticular dis- ease (diverticulosis) (ADD)	Individuals with colon, diverticula with- out gastrointes- tinal symptoms
Symptomatic diverticular disease:	
Uncomplicated (SUDD)	Patients with sympto- matic colon di- verticula (left lower quadrant abdominal pain)
Complicated (SCDD)	Patients with compli- cated colon di- verticula (hemor- rhage, peridiverti- culitis, fistulas, bowel obstruc- tion)

were introduced into the bowel lumen through the biopsy channel of the colonoscope so that the tips were at ~65-55 and ~50-40 cm from the anal margin. These were then connected to a pressure transducer (Statham P232B) and perfused with distilled water using a hydraulic perfusion system (Intraflo CFS-03F). The manometric system had a pressure rise rate of 100 mm Hg/second. All pressure recordings were made with the patients in a semirecumbent position. After a 30-minute pause, intraluminal pressure recordings were measured for a period of 6 hours, *i.e.*, 3 hours before and 3 hours after a standard meal (1,000 Kcal). The pressure recordings were analyzed with respect to 1) motility index, 2) percentage duration of activity, 3) mean amplitude, 4) total number of waves, and 5) number of waves exceeding 50 mm Hg. For the purpose of analysis, pressures of less than 10 mm Hg were ignored. All calculations were carried out by one of the authors. Results were expressed as the mean  $\pm$  SE, statistical analysis was performed using the ANOVA test (30 randomly selected patients were chosen from the 55 patients with SCDD).

Thickening of the colonic wall and length of the colonic segment with diverticula were evaluated in surgical specimens removed from patients who had already undergone surgery for SCDD. With regard to thickening of the colonic wall, the control group was composed of 10 specimens of normal sigmoid colon removed during surgery for small nonobstructive rectal neoplasms.

### RESULTS

Forty-two of 55 patients (76.3 percent) (mean age 51.1  $\pm$  2.02 years) with SCDD, and 18 of 30 subjects with SUDD (60 percent) had a motility index that was significantly higher than that of the other groups (ADD and controls) in the basal (*P*< 0.001) and in the postprandial (*P*< 0.001) periods (Table 2, Fig. 1).

During the fasting (P < 0.001) and postprandial periods (P < 0.001) the maximal amplitude of intraluminal pressure was significantly higher in SCDD and SUDD than in ADD and controls (Table 2, Figs. 1 and 2). High amplitude pressure peaks frequently exceeded 120 mm Hg. The length of colon with diverticula in the surgical specimens was 7.25 ± 1.31 cm, and the thickness of the colonic wall was  $6.25 \pm 1.25$  mm (normal values  $2.8 \pm 0.54$  mm). Four of 30 patients in the SUDD group underwent emergency surgery 14–18 months after these manometric evaluations. All had SUDD with a high motility index.

### DISCUSSION

Diverticular disease of the colon has been described as a disease that is common to western civilization. Although Painter and Truelove<sup>1</sup> and Arfwidsson<sup>2</sup> emphasized excessive intraluminal pressure as an important factor in the genesis of diverticular disease, in more recent studies<sup>3-6</sup> some conflicting results have been reported. For example, patients with asymptomatic diverticular disease have a normal motility index. Furthermore, some patients with SUDD reveal an increased motility index, but only after stimulus.

The cause of these controversies can be found in the methodology adopted in the various clinical approaches to diverticular disease. The principal methodologic errors can be identified as follows: 1) inaccuracy in the recruiting of patients, and 2) the inadequacy of recording systems.

If diverticular disease is evaluated without distinguishing its various forms, the percentage of incidence of dysmotility varies depending on the percentage of incidence of patients with ADD, or with SUDD/SCDD. It is now well known that patients with ADD have a normal motility index, whereas a varying percentage of patients with SUDD or SCDD show a hypermotility of the colon.

To obtain comparable results, it seems to be indispensable to correctly match the groups of

Summary of Manometric results and Statistical Evaluation								
	n	Basal (Mean ± SE)		Postprandial (Mean $\pm$ SE)				
		M.I.	Max. Ampl.	Percent Dur.	M.I.	Max. Ampl.	Percent Dur.	
Controls	30	107.46 ± 8.77	35.22 ± 4.20	$2.84 \pm 0.47$	193.26 ± 18.19	53.33 ± 8.33	9.22 ± 1.06	
ADD	30	116.04 ± 6.67	38.41 ± 3.28	5.05 ± 0.52	132.11 ± 12.62	$50.58 \pm 5.33$	7.79 ± 2.81	
SUDD	30	263.10 ± 3.28	$65.00 \pm 7.95$	11.73 ± 2.12	$1430.00 \pm 74.32$	98.16 ± 11.3	$34.33 \pm 5.84$	
SCDD	55	163.05 ± 29.87	103.33 ± 8.12	8.74 ± 1.45	1212.04 ± 87.29	115.41 ± 5.82	22.52 ± 3.70	
ADD vs.		N.S.	N.S.	p < 0.05	p 0.01	N.S.	N.S.	
Controls								
SUDD vs.		p < 0.001	p < 0.01	p < 0.02	p 0.001	p < 0.02	p < 0.05	
Controls		-						
SCDD vs.		p < 0.001	p < 0.001	p < 0.05	p 0.001	p < 0.001	N.S.	
Controls				-		·		
SUDD vs.		p < 0.001	p < 0.02	p < 0.05	p 0.001	p < 0.05	p < 0.01	
ADD				-		-		
SCDD vs.		p < 0.001	p < 0.001	N.S.	p 0.001	p < 0.001	p < 0.05	
ADD								

 Table 2.

 Summary of Manometric Results and Statistical Evaluation

ADD: asymptomatic diverticular disease; SUDD: symptomatic uncomplicated diverticular disease; SCDD: symptomatic complicated diverticular disease.

140 mmHç 140

100 80

> 60 40

20

n

CONTROLS







SUDD

SODD

ADD

MAXIMAL AMPLITUDE

(MEAN ± SE)

Figure 1. Motility index of control, ADD, SUDD, and SCDD groups.

patients with DD. As far as the recording system is concerned, most of the published data on colonic intraluminal pressures derive from tube assemblies positioned in the bowel through a rigid sigmoidoscope. Consequently, these studies have been largely limited to the rectosigmoid region, and many are probably confined to the rectum. In many recent studies, the distance of the most proximal pressure sensors from the anus is stated to be 20 cm or less.<sup>6,7</sup> For this reason it seems to be mandatory that the pressure sensors be positioned in the true sigmoid colon.<sup>8</sup>

Another reason why different results are ob-

Figure 2. Maximal amplitude of control, ADD, SUDD, and SCDD groups.

tained may be the different types of pressure sensors used; *e.g.*, water-filled microballoons, airfilled balloons, or open-ended tubes. As regards methodology, our study differs from others in that the patients were selected primarily on the criteria of symptom history (ADD, SUDD, and SCDD); and, secondly, the pressure sensors were positioned in the descending colon and true sigmoid colon.

The data that emerged from our study suggest that two types of diverticular disease exist. The first is associated with a normal motility index (other undetected mechanical events could produce mucosal herniation) (ADD), whereas the second is associated with an increased motility index (SUDD, SCDD).

Indeed, the patients with asymptomatic diverticular disease demonstrated no difference in colonic motility when compared with controls. Instead, subjects with symptomatic diverticular disease (uncomplicated or complicated) revealed a significant increase in motility index, mean pressure amplitude, and percentage duration of activity, both in basal and postprandial conditions, when compared with controls and ADD patients.

This hypermotility state of the colon was found in 76.3 percent of SCDD and in 60 percent of SUDD patients. All these changes are consistent with the suggestion that symptomatic diverticular disease is a motility disorder.

Other interesting findings also emerged from this study. The mean age of the patients who had undergone semielective surgery for complicated diverticular disease was approximately 50 years. Epidemiologic data suggest that diverticular disease of the colon is correlated with advancing age, but complications such as abscess formation, perforation, fistula, obstruction, and hemorrhage, may develop earlier.

In our patients who underwent surgery, the length of the colonic segment with diverticula was approximately 7–8 cm. This is a very "short segment" in comparison with the mean extension of classic diverticulosis. Finally, all our patients had a short history of left lower quadrant abdominal pain (18–32 months).

These observations convinced us to propose a number of indicators for a risk group that may develop complicated diverticular disease (Table 3). Indeed, the real problem in the management of patients with diverticular disease is, in fact, that of the patient with symptomatic uncomplicated diverticular disease. The possibility of identifying

Table 3.
Indicators of a Risk Group for SCDD

1) Age ~50 years

2) Short history of left lower quadrant abdominal pain

- 3) Short segment of colon with diverticula
- Elevated motility index (pressure amplitude exceeding 120 mmHg)

the patients in this group who have a high probability of developing complications seems to be extremely useful. A middle-aged patient (especially if male), with a short history of left lower quadrant abdominal pain, with a short segment of colon with diverticula (demonstrated by x-ray), and with an elevated motility index is a patient at risk.

It has not been yet demonstrated that a high fiber diet prevents the complications of diverticular disease, despite an increasingly widespread use of this type of diet to this end.

A surgical approach seems to be appropriate for SUDD patients at risk if the risks of macroperforation are to be prevented. Indeed it is well known that the morbidity and mortality of elective or semielective surgery is significantly lower than that of emergency surgery.

## ACKNOWLEDGMENT

The authors wish to thank Dr. Maurizio Borsotti (Laboratorio Centrale Analisi, USL 10/D) for his helpful suggestions in statistical analysis.

#### REFERENCES

- 1. Painter NS, Truelove SC. The intraluminal pressure patterns in diverticulosis of the colon. Gut 1964;5:365–9.
- 2. Arfwidsson S. Pathogenesis of a multiple diverticula of the sigmoid colon in diverticular disease. Acta Chir Scand 1964;(suppl)342:1–68.
- 3. Attisha RP, Smith AN. Pressure activity of the colon and rectum in diverticular disease before and after sigmoid myotomy. Br J Surg 1969;56:891–4.
- 4. Park TG, Connel AM. Motility studies in diverticular disease of the colon. Gut 1969;10:538–42.
- Srivastava GS, Smith AN, Painter NS. Smooth-muscle relaxant versus bran in diverticular disease. Br Med J 1976;1:315–8.
- 6. Weinreich J, Andersen D. Intraluminal pressure in the sigmoid colon. II. Patients with sigmoid diverticula and related conditions. Scand J Gastroenterol 1976;11:581–6.
- 7. Abrahamsson H, Dotevall G. Effects of propranolol on colonic pressure in patients with irritable bowel syndrome. Scand J Gastroenterol 1981;16:1021–4.
- 8. Trotman IF, Misiewicz JJ. Sigmoid motility in diverticular disease and the irritable bowel syndrome. Gut 1988;29:218–22.