Diverticulitis of the Right Colon: *
An Important Surgical Problem

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INTEREST in the surgical management of diverticulosis of the right side of the colon began in 1912, when Portier [16] reported treating a patient with acute diverticulitis of the cecum by diverticulectomy. During the past 48 years, increasing attention has been given to acute diverticulitis of the cecum and ascending colon, and the literature on this subject has benefited by the many excellent contributions [1,8,9,15,20] regarding incidence, clinical behavior, and treatment. The first reported surgical correction of acute diverticulitis of the hepatic flexure was made by Mears, Judd, and Martin [11] in 1954. Although acute inflammation is the most common indication for surgical treatment of diverticula of the right colon, it represents only one phase of a serious disease of the right side of the abdominal cavity.

Materials

The present study concerns 758 patients with a confirmed diagnosis of colonic diverticulosis. Six hundred and fifty-eight were patients at the Charity Hospital of Louisiana at New Orleans during a period of 18 years, 1942–1959 inclusive. The other 100 were at the Veterans Administration Hospital, New Orleans (Table 1). The survey was undertaken: 1) to determine the frequency of diverticula on the right side of the colon of patients in these hospitals; 2) to compare the incidence of this condition in the Caucasian and Negro races for possible variations of susceptibility; and 3) to review the complications of diverticulosis of the right side of the colon requiring operative surgical treatment to attempt to determine the surgical significance of diverticula in this area of the colon.

Incidence

The records of Charity Hospital offered convincing evidence that the frequency with which diverticularization of the right side of the colon is found depends to a considerable degree on awareness of its possible presence. During the first eight years of the 18-year period of this survey, 23 such diagnoses were recorded. The five-year period, ending in 1954, yielded 66, and in the five years ending in 1959 the figure rose steeply to 114. Only one definitive surgical procedure was performed before 1950.

Table 1 shows the incidence of diverticula of the right side of the colon at the two hospitals in this series. Of the 100 patients of Veterans Hospital with colonic diverticulosis, 28 had diverticula in the right side of the colon; in 15 of these the lesions were limited to the right side. Among the 658 patients at Charity Hospital 203 (31%) had diverticula on the right side and in 94 (14%) only the right side of the colon was affected. These figures are slightly higher than the inci-

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TABLE 1. *Site of Diverticula of the Colon (758 Patients, 1942–1959)*

Site	Charity Hospital, New Orleans		VA Hospital, New Orleans	
	No. Pts.	%	No. Pts.	%
Left side of colon	455		72	
Left and right sides of colon	109	17	13	13
Right side of colon	94	14	15	15
Totals	658	31	100	28

dence of 6.7 per cent reported by Ochsner and Bargen,[14] and by Case and Shea.[3] In the present series, although single and multiple lesions were demonstrated in all segments of the right side of the colon, multiple lesions were far more common in every segment. The ascending colon was the segment most frequently affected.

Race and Sex

In the series at Charity Hospital, where men and women of both races are represented in large numbers, the incidence of diverticulosis of the colon was highest among Negro women and lowest among Negro men (Table 2). Of the 196 Negro women, 79 (40.2%) had diverticula on the right side; and in 37 of these (18.8%) the lesions were limited to the right side. There were only 86 Negro men with diverticula. Of this group 34 (39.4%) had diverticula of the right side of the colon; in 22 of these (25.5%) the lesions were restricted to the right side. Of the white women 21 per cent had diverticula of the right side of the colon; and the white men had 26.6 per cent. Fifty-nine per cent of patients with diverticulosis of the right side of the colon were women, and 66 per cent of these women were Negroes. The ratio of Negro to Caucasian patients admitted to general medicine and general surgery at Charity Hospital is 1.5 to 1.

Complications

Acute Diverticulitis. This was the principal complication of diverticulosis of the right side of the colon that required operative intervention in this series. Thirty-one (13.4%) of the 231 patients with diverticulosis of the right side of the colon had this complication (Table 3). Five were white women, eight were white men, 12 were Negro women, and six Negro men. The average age of these patients was 68 years. However, for those with cecal lesions the average age was 47 years, slightly higher than the average age of 40.4 years reported by Lauridsen and Ross.[9] The cecum, as expected, harbored more than half of these—18 (58%). Acute diverticulitis of the hepatic flexure and proximal transverse colon, although rare, were deceptive and dangerous lesions accompanied by high case fatality rates in

TABLE 2. *Distribution of Diverticulosis by Sex and Race (658 Patients at Charity Hospital of Louisiana at New Orleans)*

Site	White				Negro			
	Women		Men		Women		Men	
	No. Pts.	%	No. Pts.	%	No. Pts.	%	No. Pts.	%
Left side	149		137		117		52	
Right and left side	27	14.2	28	14.9	42	21.4	12	13.9
Right side	13	6.8	22	11.7	37	18.8	22	25.5
Totals	189	21.0	187	26.6	196	40.2	86	39.4

TABLE 3. *Acute Diverticulitis of Right Side of Colon (738 Patients)*

Sites	No. Pts.	Solitary Lesion	Mass	Open Perforation	Operation	Conservative
Cecum	18	11	11	2	14	4
Ascending colon	6	3	2	0	4	2
Hepatic flexure	5	4	4	2	4	1
Proximal transverse colon	2	1	1	2	1	0
Totals	31	19	18	6	23	7

this series. The 18 masses listed were of two types: 1) intramural; and 2) pericecal or pericolic.

There were no correct diagnoses of acute diverticulitis made preoperatively at either of the two hospitals. Although Anderson [1] reported six per cent accuracy for 91 patients, in this series it appeared to be impossible to differentiate acute diverticulitis of the cecum and proximal ascending colon from acute appendicitis, or acute diverticulitis of the hepatic flexure and proximal transverse colon from acute cholecystitis. Carcinoma was suspected when inflammatory masses were found at operation, and the inability to exclude carcinoma was the reason for nine radical resections of the right colon. The use of colotomy on two patients made positive identification of the lesion possible and permitted the use of less radical procedures.

Definitive operation was performed on 18 of these 31 patients (Table 4). One death at Charity Hospital followed the first stage of a two-stage resection, which had included ileostomy. Death occurred on the fifty-sixth postoperative day and was attributed to fluid and electrolyte depletion. The operative case fatality was five per cent. There were no fatalities among the seven patients with local abscesses treated conservatively in the hospitals.

Palliative operations were performed on five of six patients who entered Charity Hospital with diffuse peritonitis from perforations of acute diverticulitis; two had lesions of the cecum, two in the hepatic flexure, and two in the proximal transverse colon. Decompressive cecostomies and drainage of large pockets of purulent exudate were carried out. One patient with a perforated cecal diverticulum survived. The sixth patient died of myocardial infarction shortly after being admitted to the hospital.

Two patients with acute diverticulitis of the cecum died while being admitted to Charity Hospital. On postmortem examination one was found to have acute diverticulitis of multiple diverticula of the cecum and peritonitis in the lower right quadrant. Death was attributed to suffocation from aspirated vomitus. The second patient died of massive pulmonary infarction.

The over all case fatality rate in this series for acute diverticulitis of the right side of the colon was 22 per cent. Buck [2] recently reported a case fatality rate of

TABLE 4. *Deaths After Definitive Operation Acute Diverticulitis of Right Side of Colon (31 patients)*

Operation	No. Pts.	Deaths
Diverticulectomy	7	0
Colectomy, right, partial	2	0
Colectomy, right one-stage	4	0
Colectomy, right two-stage	5	1
Totals	18	1

TABLE 5. *Subacute and Chronic Diverticulitis of the Right Side of the Colon. Surgical Treatment*

Patient No.	Age	Race and Sex	Preoperative Diagnosis	Surgical Pathological Diagnosis	Operation*
1.	65	W F	Diverticulum of ascending colon	Same	Diverticulectomy
2.	68	W F	Diverticula of ascending colon	Same	Appendectomy
3.	59	W M	Carcinoma of cecum	Diverticulum of cecum	Cecectomy
4.	42	W M	Carcinoma of cecum	Diverticulum of ascending colon	Appendectomy
5.	82	N F	Carcinoma of proximal transverse colon	Diverticulum of hepatic flexure	Right hemicolectomy
6.	55	W M	Carcinoma of ascending colon	Diverticulum, chronic granuloma	Right hemicolectomy
7.	74	N F	Carcinoma of hepatic flexure	Diverticula of hepatic flexure	Lysis of adhesions
8.	56	W M	Carcinoma of ascending colon	Diverticulum of ascending colon	Colotomy partial resection
9.	58	N F	Carcinoma of hepatic flexure, external fistula	Diverticulitis, granuloma, external fistula	Colotomy, resection of hepatic flexure
10.	66	W M	Cholecystocolic fistula	Cholecystodiverticulocolic fistula	Cholecystectomy diverticuelctomy
11.	32	N F	Uterine leiomyoma	Leiomyoma of diverticulum of transverse colon	Diverticulectomy

* All recovered.

23 per cent for all complications of diverticulosis of the colon treated at Charity Hospital during the six-year period 1950–1955 inclusive.

Chronic Diverticulitis. Another group of patients had less imperative symptoms which were usually difficult to associate with diverticula of the right side of the colon. Subacute and chronically diseased diverticula often simulate recurring appendicitis, biliary colic, cholelithiasis, peptic ulcer, carcinoma of the colon, and various subacute and chronic diseases of the female pelvis.

The records of patients with recurring subacute and chronic diverticulitis are usually voluminous with notations of medical attention received during periods ranging from one to ten or more years. Periodic re-examinations of the alimentary canal and the biliary system, to ferret out a commoner cause for the symptoms, reveal only the persistent single or multiple diverticula of the right side of the colon. In the present series the appendix, gallbladder, and perhaps some of the female organs had been removed without noticeable relief of symptoms.

Pain at irregular intervals is the most constant complaint of patients with chronic diverticulitis. However, the occasional mildness of the pain and the denial of its presence by three patients of this series were puzzling, in view of the advanced pathologic lesions demonstrated roentgenographically and on abdominal exploration. Irregularities of intestinal function, common to diverticular disease of the left side of the colon, were rare, except when copious bleeding or obstruction occurred.

Nausea, vomiting, or both were experienced by 18 of 26 patients.

Among the 109 patients with diverticula limited to the right side of the colon, 26 were classified as having symptomatic chronic diverticulitis. Eleven of the 26, operated on at the two hospitals of this survey, are listed in Table 5. The prime indication for abdominal exploration was the necessity of eliminating carcinoma as the cause of deformities of the right side of the colon demonstrated radiographically. Seven of the 11 patients listed were explored for the reason. Colotomy, when used, again proved to be valuable as a diagnostic aid.

Patient 1 (Table 5) was the only one in this series who was operated on for the express purpose of removing a diverticulum of the ascending colon by diverticulectomy. Patient 2 was explored for recurring pain and periodic episodes of moderate melena. Diverticula were known to be present in the cecum and ascending colon. Adhesions to the ascending colon were divided, and the appendix was removed.

Patients 6, 9, 10 and 11, with rare lesions of the right side of the colon are worthy of brief descriptions.

Case Reports

Patient No. 6. A white man, aged 55 years, entered VA Hospital with symptoms and signs of complete intestinal obstruction of the colon. The scout film of the abdomen indicated that the obstructing lesion was in the ascending colon. Roentgenograms made after barium enema demonstrated the obstruction to be in the distal portion of the ascending colon. The obstructing lesion was considered to be carcinoma. Cecostomy was not done because the patient began to expel gas shortly after his arrival at the hospital. After complete symptomatic recovery from intestinal obstruction and adequate preparation of the colon, right colectomy was done. The pathologist identified the obstructing lesion as a solitary diverticulum of the ascending colon surrounded by a subacute and chronic granuloma. Acute complete obstruction of the right side of the colon by diverticulitis is rarely seen, although filling defects were present in six other patients (Nos. 3, 4, 5, 7, 8, 9—Table 5).

Patient No. 9. A Negro woman, aged 58 years, was admitted to Charity Hospital with purulent and fecal material draining from a small, old incision in her right flank. Approximately one year before admission, she was treated at home for pain in the right upper quadrant of the abdomen and for fever. An abscess developed in the right flank, which required her entering a hospital for incision and drainage. The wound continued to discharge pus and never completely healed.

Roentgenograms made while an opaque medium was injected into the tract demonstrated a colocutaneous fistula entering the hepatic flexure. Roentgenograms made with barium enema outlined a mass in the hepatic flexure which suggested that carcinoma might be the primary lesion. An operation performed December 1, 1951, confirmed the presence of a mass in the hepatic flexure. The mass was firmly adherent to the abdominal wall and could not be differentiated from carcinoma. Colotomy provided adequate inspection of the mucous membrane and the orifice of a diverticulum was identified. A one-stage resection of the hepatic flexure was carried out. The report of the pathologist was diverticulitis of the colon with subacute and chronic granuloma and fecal fistula.

Patient No. 10. This 66-year-old white man entered the medical service of VA Hospital because of pulmonary emphysema. He also complained of vague epigastric discomfort. During the medical survey, a scout roentgenogram of the abdomen showed the biliary ductal system to be outlined with gas. A short gastro-intestinal series failed to demonstrate a communication between the biliary system and the stomach or duodenum. After the administration of iodiamide-methylglucamine, the opaque medium was seen to enter the hepatic flexure of the colon. Films made after administration of a barium enema showed that barium had entered the gallbladder. Bilateral diverticulosis of the colon was also demonstrable. The roentgenographic diagnosis was cholecystocolic fistula entering the hepatic flexure of the colon. Careful repeated questioning of the patient about his past illnesses failed to produce any useful information concerning the date of origin of the internal fistula.

When the upper right quadrant of the abdomen was explored, the communication was found to be between the ampulla of a small, thickwalled gallbladder and a large diverticulum with a narrow opening into the hepatic flexure. The structure identified in the roentgenogram as the gallbladder was actually the diverticulum.

One-stage diverticulectomy and cholecystectomy were done. Experience with a similar fistula has been mentioned by Donaldson.[5]

Patient No. 11. This colored woman, aged 32 years, was admitted to Charity Hospital April 30, 1954. She was accepted for exploration of her pelvis because of a large mass, apparently of uterine origin, which had been found on pelvic examination. She complained of pelvic discomfort and mild epigastric distress but no other distressing symptoms. The preoperative diagnosis was leiomyoma of the body of the uterus.

A pelvic exploration confirmed the presence of a large tumor that measured 21 × 13 × 4 cm. The gross appearance of the tumor was that of a benign leiomyoma of the uterus. However, the mass was not connected to any pelvic organ but was lodged in the wall of a diverticulum of the transverse colon. The neck of the diverticulum measured 5 cm. The pathologist reported the specimen to be a benign leiomyoma in the wall of a diverticulum of the colon.

A question may be raised regarding the origin of the diverticulum. It may have represented a congenital diverticulum with a muscular coat, or it may have originated from the traction of a leiomyoma of the transverse colon.

Hemorrhage

Melena has become generally accepted as a symptom of diverticulosis or diverticulitis of the colon. Massive bleeding, however, is not universally recognized as a symptom associated with colonic diverticula. Surgeons with wide experience in the management of diverticular disease of the colon have reported widely varying incidences for massive hemorrhage, ranging from O [4, 12] to 48.8 [17] per cent. Rives and Emmett [18] and others [6, 7, 13, 19, 21] have stressed the association of copious melena with diverticular disease of the colon.

In the present series melena was an outstanding symptom among the patients at Charity Hospital with diverticulosis of the right side of the colon. Of the total 203, 78 of them (38.4%) entered the hospital because of melena or gave histories of having bright red or maroon stools. Among the patients with diverticula limited to the right side of the colon, the incidence of hemorrhage was 47 per cent.

Twenty-two patients, 21 at Charity Hospital and one at Veterans Hospital, were considered to have had massive hemorrhages. Fourteen of these responded satisfactorily to adequate replacement of blood, and the bleeding was self-limited. The other eight patients (Table 6—Nos. 3, 4, 5, 6, 7, 10, 11, 12) continued to bleed without signs of abatement. They were, therefore, submitted to emergency operation. Five patients (Table 6—Nos. 1, 2, 8, 9, 13) among those who stopped bleeding under conservative treatment received elective operation. The age of the patients operated on ranged from 47 to 81 years, with an average of 61.8 years. Three were white men, five were Negro women and the other five were Negro men.

Eight of the 13 patients operated on have had no intestinal bleeding during periods ranging from seven months to 3.5 years. Patient 1 (Table 6), free of melena for two years after right hemicolectomy, returned to Charity Hospital because of tarry stools and epigastric pain. Roentgenograms demonstrated a small duodenal ulcer which healed promptly under medical therapy. Patient 12 with diverticula in all segments of the colon, had the left side of the colon removed in 1959, because of copious bloody stools. The return of fresh blood in the stool in March 1960, may be presumed to be caused by the diverticula in the right side of the colon, although diverticula are also present in the jejunum and ileum. Patient 13, a 73-year-old colored woman, was admitted to Charity Hospital in 1955, because of profuse bleeding from the lower intestinal tract. The cause of melena was attributed to diverticulosis of the ascending colon. Bright red stools reappeared at irregular intervals and required hospitalization for three episodes. The last admission for bleeding was November 9, 1959. Films after barium enema, made shortly after admission, exhibited a filling defect of the cecum which suggested the presence of carcinoma. The

TABLE 6. *Diverticulosis and Diverticulitis of the Right Side of the Colon. Surgical Treatment for Massive Hemorrhage*

Patient No.	Age	Race and Sex	Site of Diverticula	Operation	Result
1.	47	N M	Multiple ascending colon	Interval right hemicolectomy	Recurrence after 2 years
2.	57	W M	Multiple cecum ascending colon	Interval subtotal colectomy	Good 3.5 years
3.	49	N F	Ascending colon hepatic flexure transverse colon	Emergency. Subtotal colectomy	Good 1 year
4.	59	N M	Cecum, ascending colon hepatic flexure	Emergency. Subtotal colectomy	Good 3 years
5.	49	N M	Multiple of cecum and 1 of ileum	Emergency. Exploratory appendectomy	Unknown
6.	77	N F	Ascending colon and hepatic flexure	Emergency. Right hemicolectomy	Good 7 months
7.	68	N M	Cecum, ascending colon and hepatic flexure	Emergency. Right hemicolectomy	Died
8.	56	N M	Ascending colon and hepatic flexure	Interval. Right hemicolectomy	Good 3 years
9.	58	W M	Ascending colon, hepatic flexure, proximal transverse colon	Emergency. Subtotal colectomy	Died
10.	54	N F	Cecum and ascending colon	Emergency. Subtotal colectomy	Good 1 year
11.*	41	N F	Cecum and ileum	Interval. Right hemicolectomy	Good
12.*	81	N F	Throughout colon, jejunum and ileum	Emergency. Left hemicolectomy	Recurrence
13.*	73	N F	Ascending colon and carcinoma of cecum	Interval. Right hemicolectomy	Good 11 months

* Bleeding presumed to be from diverticula of the right side of the colon.

right colon was removed, and the presence of both the diverticula and the carcinoma was verified by the pathologist. The behavioral pattern of the hemorrhage during a five-year period suggests that diverticulosis was the source; however, the evidence is presumptive. One death followed a right hemicolectomy and another a subtotal colectomy (Table 7). Both patients, one at Charity Hospital and the other at VA Hospital, were operated on to arrest exsanguinating hemorrhage, and did not recover from the excessive loss of blood.

Discussion

Diverticulosis of the colon is common to the Caucasian race and Negro women, but is found less frequently among Negro men. Negro women and white men comprise 67 per cent of the patients with severe complications of diverticulosis of the right side of the colon in this series. The Negro patients had a greater tendency to bleed profusely than did the white. Seventy-six per cent of the patients who required operation for copious hemorrhage were Negroes.

In this series it was not possible to determine the incidence of smooth muscle fibers in the structure of diverticula. The presence or absence of a muscular layer was not mentioned in the reports of the pathologists. Lauridsen and Ross [11] found

an incidence of 71.9 per cent among the reported cases with microscopic examinations of specimens. The clinical value of classifying diverticula into congenital and acquired groups is questionable, although the anatomical basis for the classification may be sound. The findings at operation, however, indicate that the site of origin of the diverticulum, determines to a considerable degree the trend of complications which follow perforation. Intra mural diverticula, first described by Mayo, Wilson and Griffin [10] in 1907, produce masses within the wall of the intestine; intramesenteric and diverticula in the appendices epiploicae tend to form pericolic abscesses; and diverticula emerging from the surface of the colon covered by peritoneum may perforate directly into the peritoneal cavity.

The high case fatality rate of 87.5 per cent which accompanied delayed hospitalization of elderly patients with acute diverticulitis of the right side of the colon is most distressing. These patients gave little evidence of the severity of their illness until the grave symptoms and signs of spreading peritonitis appeared. Simple diverticulectomy may have saved them had they been admitted to the hospitals before perforations occurred. Furthermore, the high case fatality rate of 22 per cent among the patients with acute diverticulitis of the right side of the colon should reserve the consideration of those who believe that operation is less urgently needed than in the case of acute appendicitis.

TABLE 7. *Right Colonic Diverticulosis with Massive Hemorrhage. Surgical Deaths among 13 Patients*

Operation	No. Pts.	Deaths	
		No.	%
Hemicolectomy, right	7	1	
Colectomy, subtotal	4	1	
Hemicolectomy, left	1	0	
Exploration	1	0	
Totals	13	2	15.3

In this series 24 of the 47 patients operated on had chronic forms of diverticulitis or massive hemorrhage from diverticula (Table 8). Repeated hospitalizations for treatment and re-examination seriously affected the economic welfare of patients with chronic diverticulitis and those with periodic massive melena. A more aggressive surgical approach may solve the problems of these patients, and is worthy of serious consideration.

Summary

Diverticulosis of the right side of the colon is a fairly common disease of the Caucasian and Negro races. In this series of the 658 patients from Charity Hospital, New Orleans, its incidence was highest

TABLE 8. *Acute Diverticulitis, Chronic Diverticulitis, Massive Hemorrhage of Right Side of Colon. Distribution by Sex and Color of 55 Patients; 47 Operative, 7 Conservative Treatment and 1 Death Shortly after Admission*

Types	Patients									
	White				Negro				Total	
	Women		Men		Women		Men			
	No.	%	No.	%	No.	%	No.	%	No.	%
Acute	5		8		12		6		31	
Chronic	2		5		4		0		11	
Hemorrhage	0		3		5		5		13	
Totals	7	13	16	29	21	38	11	20	55	100

among Negro women and least among Negro men. Acute and chronic diverticulitis of the right side of the colon follows the same behavior pattern as when the disease is localized on the left side but is considerably more difficult to identify. Four unusual lesions of the right side of the colon are described.

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Discussion

Dr. James C. Drye: In 1954, Dr. Rudolf J. Noer presented a paper at the Southern Surgical Association related to bleeding from diverticular disease of the colon; although the data presented and the photomicrographs, including one of a vessel along the neck of a diverticulum which obviously had been bleeding and contained a clot seemed conclusive evidence that serious bleeding could come from a diverticula of the colon, some accepted this with reluctance. I am glad to hear Dr. Quinn's report of this large series of cases. It is further evidence that bleeding can occur from diverticula of the colon.

The other paper about bleeding from the right colon somewhat disturbs me. In our experience bleeding has occurred only from the left colon and I have always been satisfied in resecting the left colon to get to the bleeding point. Dr. Miangolarra has shown that bleeding does occur from the right and we must review our thinking.