

Diverticular Disease of the Colon *

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IN THESE DAYS of changing concepts of many diseases it is well to review the experience of medical clinics and teaching institutions toward the objective of arriving at more logical approaches to the management of diverticular disease of the colon.

The term "diverticular disease" was introduced by Rosser¹³ in 1955. For years it was believed that diverticulosis possessed little clinical significance and only when the diverticula became involved by inflammatory changes did the condition become a disease entity. Although diverticulitis has been managed medically for years and surgical operation has been reserved for complications, recent reports indicate that surgical treatment is being utilized more frequently when there are no complications.

The classification of diverticulitis, diverticulosis and diverticulitis with complications into three separate clinical entities requiring different methods of management is not justifiable. The three conditions should be considered manifestations of the same process. If this concept is acceptable management of the condition should be based on the same basic principles, regardless of the stage of the disease.

Advancement in surgical technic, preoperative and postoperative care, anesthesia and ancillary factors in the care of patients during recent years have led to a more liberal attitude on the part of many surgeons

in the management of diverticular disease of the colon. However, most surgeons still occupy a conservative position and are loath to operate for diverticular disease unless complications develop. This attitude may lead to disaster, and should be abandoned. Preventive surgical intervention is now being accepted by some authorities as a logical procedure and should be utilized more frequently.

It is the purpose of this paper to show that surgical intervention in asymptomatic diverticular disease is a justifiable procedure which should not be deferred until complications develop.

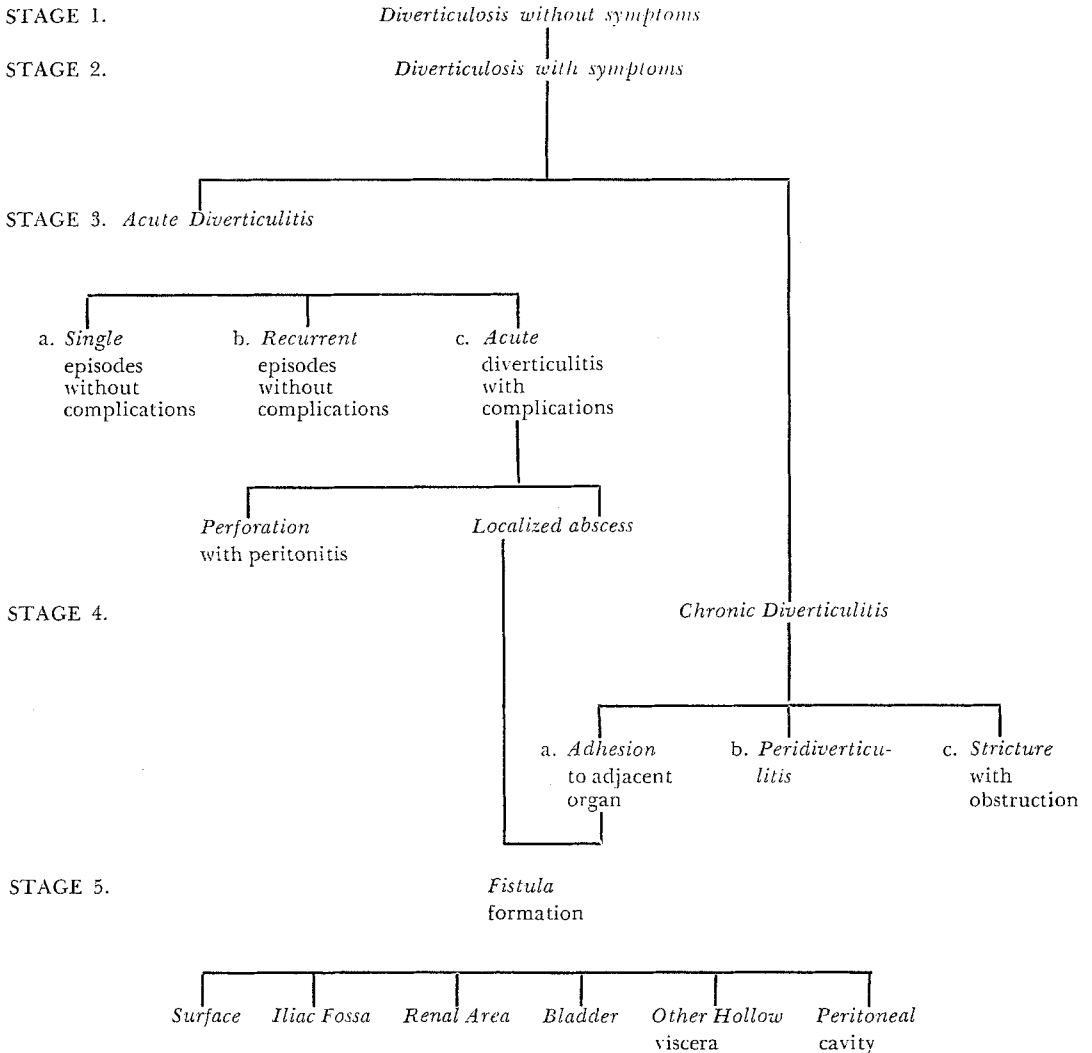
Historical Review

A description of diverticula appeared in Baillie's *Morbid Anatomy* in 1793, but it was not until 1842 that Cruveilhier⁴ described the condition as a disease entity. In 1853, Virchow¹⁸ introduced the terms "peridiverticulitis" and "chronic adhesive peritonitis" when he described "certain inflammatory areas at the hepatic, splenic and sigmoid flexures of the colon." The clinical importance of intestinal diverticula was first stressed by Graser⁶ in 1898. He referred particularly to the hyperplastic stenosing type which results from inflammatory changes associated with diverticula of the sigmoid.

In 1906, Moynihan¹⁰ presented to the Clinical Society of London his treatise on the disease which he believed to be a mimicry of malignant disease of the colon. This was the first report of a surgical operation for diverticulitis. The next year, W. J. Mayo⁹ reported on five patients who had under-

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TABLE 1. *Diverticular Disease of the Colon*



gone surgical operation for diverticulitis at the Mayo Clinic. In each case resection of the sigmoid was performed, and in all the gross appearance of the lesion was similar to that of carcinoma. Later, additional cases were reported, in some of which carcinoma was associated. This led to the belief that diverticulitis of the colon bears some relationship to the development of carcinoma. This concept held favor until the middle of the third decade of this century, when a number of reports appeared

which cast doubt on its authenticity. Finally, in 1952, in an exhaustive review of all available reports in the English literature, Rowe and Kollmar¹⁵ found only 62 cases of proved carcinoma associated with diverticulitis.

Classification

Because of the unsatisfactory character of existing classifications, acceptance of the following modification of Maingot's classification (Table 1) is suggested.

Stage 1. Diverticulosis Without Symptoms: Most patients who have diverticula never have symptoms and require no therapy. However, the accidental discovery of colonic diverticula should not be considered trivial. Obviously, simple asymptomatic diverticula must be present before conditions which can produce symptoms can develop. It is impossible to predict when complications will develop in given patients, but the discovery of diverticula should always be revealed to the patient and he should be told of the possibility of trouble in the future.

Stage 2. Diverticulosis With Symptoms: As a rule, the symptoms of diverticulitis are absent or mild. There may be intermittent flatulence with occasional slight crampy discomfort, slight abdominal distention and mild irregularity of bowel movements. Hemorrhage once was considered a rare complication of either diverticulitis or diverticulosis, but it now ranks with obstruction, perforation and fistula.¹ Massive hemorrhage from diverticulosis has been reported by several authors and recently there have been reports of cases in which surgical intervention was required because of hemorrhage from diverticula which were not involved by inflammation. In 1939, Rosser wrote: "While there should be no relaxation of the attempt to determine the presence of some additional lesion which might produce bleeding, particularly cancer of the bowel . . . , the prevalent opinion that diverticulitis never bleeds is thoroughly unwarranted."¹²

Stage 3. Acute Diverticulitis: (a). Acute diverticulitis may vary widely in manifestations. A single acute episode may last only a few hours or it may continue for several days. In either case the condition may subside spontaneously and leave no residual effect. Roentgenologic studies may reveal no evidence of diverticulitis.

(b). There may be episodes similar to those of stage (a), but these recur. There

may be periods of remission lasting days, weeks, months or even years during which patients may have few symptoms or none at all, but during the acute phases serious complications may occur.

(c). This phase often taxes the physician's skill and ingenuity. In many cases diverticulitis is not suspected until there is an acute episode accompanied by serious complications. There may be perforation and generalized peritonitis or a localized abscess. The latter is more common. Hayden and Krolicki⁷ reported only four cases of generalized peritonitis in a series of 140 cases of diverticulitis. Abscesses may penetrate the usually closed spaces of the iliac fossa and the prerenal areas or they may perforate into bladder, intestine, vagina, rectum, fallopian tubes and abdominal wall. Occasionally, they may burrow into the pelvis and form presacral or supraleator abscesses. In such cases the utmost surgical judgment and skill are required, and it is universally agreed that surgical intervention is indispensable.

Stage 4. Chronic Diverticulitis: Chronic diverticulitis occurs as a result of long-standing, low-grade, recurrent inflammatory processes which usually are characterized by progressive constipation, obstipation, dyspepsia and abdominal discomfort. As the disease progresses, there may be adhesion of the involved bowel to adjacent structures, chronic peridiverticulitis and pericolitis, fibrosis and scarring and the gradual development of stricture and obstruction. Sometimes acute episodes are superimposed, with the result that complications usually associated with acute diverticulitis may occur. Frequently, in this stage, it is impossible to distinguish between diverticulitis and carcinoma. As has been pointed out, it is now believed that there probably is no relationship between diverticular disease and carcinoma, but the coincidental occurrence of the two is sufficient indication for resection of the involved segment of bowel.

Incidence

It is impossible to give an accurate estimate of the incidence of diverticular disease in the general population. In 1927, Spriggs and Marxer¹⁷ reported an incidence of 10 per cent of multiple diverticula of the colon in routine roentgenologic studies. In 1930, Rankin and Brown¹¹ recorded an incidence of 5.6 per cent in 24,620 roentgenologic examinations of the colon performed at the Mayo Clinic. In 1937, Buie³ reported on 52,411 roentgenologic examinations of the colon performed by Weber and his associates on patients at the Mayo Clinic in which the incidence of diverticula was 5.9 per cent. In 1939, Edwards⁵ reported an incidence of 11.87 per cent among 2,136 patients who had roentgenologic examination of the colon. Maingot⁸ wrote that diverticulosis is slightly more common in males. This view is also supported by Rankin and Brown,¹¹ Springs and Marxer¹⁷ and Welch, Allen and Donaldson¹⁹ (Table 2).

Most authors agree that diverticulitis and its complications occur more frequently in males than in females. Shackelford¹⁶ found that diverticulitis was one-and-a-half times more common in men than in women.

Boyd² wrote that inflammation in diverticula occurs in about 15 per cent of cases of diverticulosis. In reports of other authors this percentage varies from 11 to 35 per cent. It is now generally accepted that diverticulitis may be expected to occur in 20 to 25 per cent of patients who have diverticula of the colon.

Clinical Aspects

Material: The material for this clinical

TABLE 2. *Reported Incidence of Diverticula*

Study	Year	Percentage
Spriggs and Marxer ¹⁷	1927	10
Rankin and Brown ¹¹	1930	5.6
Buie ³	1937	5.9
Edwards ⁵	1939	11.87
Boyd ²	1955	10 (Males)

TABLE 3. *Distribution of Patients According to Age*

Age	Patients
1-20	1
21-30	5
31-40	15
41-50	20
51-60	77
61-70	59
71-80	24
81-90	5
Total	215

study of diverticular disease of the colon was obtained from records of a series of patients treated consecutively in the Department of Proctology of Temple University Medical Center from September 1940, to June 1957, inclusive. In former publications various aspects of the problem have been recorded¹ and while all previous cases have been included in the present report for statistical purposes, particular attention is now directed toward patients observed during the past two years.

In the 17-year period from 1940 to 1957, 215 patients with diverticulitis have been treated in this department. Of the 215 patients, 111 (51.6 per cent) have undergone surgical operations.

It is interesting to note the increasing number of patients treated surgically in this series. In 1948, 30.8 per cent were treated surgically; in 1950, the percentage increased to 35.1 per cent. By 1955, the incidence of surgical intervention was 46 per cent. Since 1948, 111 patients have been treated for diverticular disease. Of these, 79 (70.6 per cent) were treated surgically. Of the last 27 patients admitted since November 1955, all but one have undergone some type of surgical operation.

Age: It is generally accepted that diverticular disease is associated with middle age, but in the majority of cases the disease occurs during the sixth and seventh decades. We have found that this is generally true, but it is not uncommon to see patients in their twenties and thirties with diverticular

disease. The distribution according to age in this series is shown in Table 3.

It will be noted that one patient was less than 20 years old. The patient was a child of eight years who had a massive rectal hemorrhage. The only findings after extensive study were diverticula of the colon.

Symptoms: It has been pointed out that the symptoms of diverticular disease may vary considerably. The symptoms and signs of each stage have been discussed.

Most patients in this series appeared on the proctologic service after previous medical treatment or surgical treatment or both, and many presented complex problems.

The most common presenting symptom was abdominal pain. Pain of some type in the abdomen was reported by 83.7 per cent of patients. Usually the pain is in the left lower abdominal quadrant and is described as a "dull ache," but it may vary from slight discomfort to severe colic. Occasionally it is characterized as a "pulling" or "bearing-down" sensation, and frequently it is referred to the back. In most cases it is due to spasm of the wall of the bowel except in those cases in which there is penetration or infiltration of the peritoneum. In these cases, there are abdominal tenderness and muscle spasm characteristics of peritonitis.

Constipation was present in 68.3 per cent of our patients, but it is doubtful that it possesses etiologic significance. Diarrhea occurred in only 11.1 per cent of our patients. Diarrhea alternating with constipation was experienced by 12.7 per cent. This probably was medically induced, and is difficult to evaluate. Most patients with constipation use laxative and purgative agents and induce diarrhea by overdosage. This seems to be particularly common among women.

An important symptom which has been discussed previously is bleeding. When gross rectal bleeding occurs, regardless of the presence of other symptoms, the pri-

mary objective of the physician must be to rule out carcinoma. In many cases of diverticulitis with formation of stricture, this can be accomplished only by resection of the involved segment of bowel and thorough microscopic study. In this series, 18 per cent of patients had gross rectal bleeding.

A surprising number of patients discover a mass in the abdomen. Of our patients, 19.6 per cent said they had felt a tumor in the abdomen. A mass, if felt, usually is in the left lower quadrant and is frequently accompanied by tenderness.

Passage of gas through the urethra occurred in 16.3 per cent of our patients. This, of course, is indicative of a fistulous connection between the bowel and the bladder or urethra. A history of frequency, dysuria, nocturia and burning may precede the development of a fistula and pneumaturia. Any patient who has urinary symptoms should have a complete urologic examination.

Surgical Treatment: It is the purpose of this review to reveal and to justify the changing concept regarding the surgical management of diverticular disease of the colon. Unfortunately, no accurate record of the number of cases of stage 1, or asymptomatic diverticulosis, is available. With few exceptions, patients were encountered during the inflammatory stage of the disease (diverticulitis) or when there were complications. One hundred and eleven operations were performed on the 215 patients studied in this review (Table 4). Of the 111 surgical procedures, 94 were resections and 17 were palliative procedures. From 1940 to 1948, 32 patients underwent surgical operation. Resection was performed in 21 cases, with an operative mortality rate of 4.7 per cent. Six operations were performed by the exteriorization method of Mikulicz; three by abdominoperineal proctosigmoidectomy; six by resection with end-to-end anastomosis; and six by sigmoidectomy with permanent colonic

TABLE 4. *Surgical Management of Diverticular Disease*

Operations	Patients, no.	Deaths, no.	Percentage
Total operations	111	4	3.7
Definitive resections	94	2	2.2
Palliative operations	17	2	11.8
Resection, type			
Resection with primary anastomosis	62	2	3.3
Partial cystectomy with colonic resection open anastomosis	10	0	0
Partial cystectomy, sigmoidectomy, with preliminary colostomy (3 stage)	3	0	0
Ileocelectomy, abdominoperineal proctosigmoidectomy for associated carcinoma of cecum	1	0	0
Mikulicz type resection (1940-1948)	7	0	0
Abdominoperineal proctosigmoidectomy with preservation of sphincters	6	0	0
Left hemicolectomy with transplant of transverse colon to perineum, preservation of sphincters	2	0	0
Abdominoperineal excision (Miles) (associated carcinoma)	1	0	0
Sigmoidectomy with colostomy (Hartmann)	2	0	0
Operative cases without resection			
Colostomy for obstruction or fistula	9	1	11.1
Incision and drainage of abscess	3	1	33.3
Drainage for perforation without closure	2	0	0
Exploration only	3	0	0
Total	17	2	11.8

stoma established by the Hartmann method. Partial cystectomy was required in four cases. In all these cases the problem was complicated and in practically all cases the operations performed were multiple-stage procedures. Defunctionalizing colostomy was performed prior to resection in all cases.

From 1948 to 1950, eight additional resections were performed. One was abdominoperineal proctosigmoidectomy; one was abdominoperineal proctosigmoidectomy and hemicolectomy; and in six cases resection and end-to-end anastomosis was performed. There were no operative deaths and, as a result, the over-all mortality rate for resections was reduced to 3.4 per cent. During this period, the indications for surgical intervention were complications of chronic or recurring diverticulitis.

Five years later, in 1955, the attitude of surgeons had become less conservative. It had become apparent that patients with

acute, subacute or chronic diverticulitis are entitled to "preventive" resection of the involved segment of bowel despite the absence of surgical complications. By that time we had performed 73 resections. There had been only 29 resections prior to 1950. Of the 44 resections performed from 1950 to 1955, 32 were primary open anastomoses. In most of these cases preliminary proximal colostomy was not performed. There were seven resections with primary anastomoses in which partial cystectomy had been required. There was one total colectomy and abdominoperineal proctosigmoidectomy for associated carcinoma of the cecum, and one abdominoperineal excision (Miles type) for associated carcinoma of the rectum. The mortality rate for all resections prior to 1955, was 2.7 per cent.

Since November 1955, 24 surgical procedures have been performed for diverticular disease. Of these, 21 were resections and three were palliative procedures. Two of

the palliative procedures were transverse colostomies for obstruction due to diverticulitis. One patient subsequently went elsewhere for further treatment and the other died several months later with carcinoma of the liver. One patient underwent surgical exploration, and carcinoma of the pancreas was found. Of the 21 resections performed since November 1955, 16 were primary resections with open end-to-end anastomoses without proximal colostomy. In this group there was one post-operative death due to congestive heart failure. One patient, an elderly obese woman, underwent primary resection and cecostomy because of technical difficulty with the anastomosis and poor general health. Two patients underwent sigmoidectomy with end-to-end anastomosis about six weeks after the performance of transverse colostomy for acute diverticulitis. Closure of the colonic stomas was performed about two weeks later, after roentgenologic examination revealed patency of a healed anastomosis. The remaining patient of this group had a sigmoidovesical fistula. Transverse colostomy and suprapubic cystotomy were performed as the initial stage of a three-stage procedure. The second stage consisted of sigmoidectomy with end-to-end anastomosis and partial cystectomy, and the final stage was closure of the transverse colonic stoma.

In this last group of 21 patients who underwent resection, there were two patients with adenomatous polyps in the involved portion of the sigmoid and one patient with an associated carcinoma of the sigmoid.

Rehabilitation: The only satisfactory methods for the accurate determination of the validity of any surgical or medical therapeutic method are follow up study and evaluation. The primary concern of the surgeon is to return the patient, if possible to a state of health which will permit him to resume activities in which he participated prior to his illness. Thus,

the morbidity and the degree of economic disability imposed upon the patient must deserve serious consideration.

A thorough attempt has been made to carry out careful follow up studies of this series of resections for diverticular disease of the colon. Unfortunately, 13 of the 94 patients' records have not been available for this study.

Of the 94 patients who underwent resection, 71 were known to be free of all symptoms and in good health at the time of this report. Five patients experienced mild distress periodically which did not interfere with normal activities. One patient had periodic episodes of rather severe distress which interfered with his ability to work.

Two patients died. One death was due to congestive heart failure and the other was due to peritonitis after resection and end-to-end anastomosis. This patient was operated upon before the advent of wide-spectrum antibiotic agents.

With *complete* follow up studies on 81 patients who underwent resection it has been determined that 76 of the 77 patients were able to work and carry on their usual activities. These patients were fully rehabilitated. This represents a rehabilitation rate of 98.7 per cent.

Summary and Conclusions

Diverticular disease of the colon for many years was considered to be primarily a medical problem, and operation was reserved for those patients in whom complications developed. It is becoming apparent now that the treatment of uncomplicated diverticular disease should be surgical. For many years it was felt that carcinoma frequently was associated with diverticulitis, and that association was one reason for surgical intervention. It is agreed now that there is little relationship between diverticulitis and carcinoma.

A comprehensive classification of diverticular disease has been presented. In this

classification the previous division of diverticular disease into the separate entities of diverticulosis, diverticulitis and diverticulitis with complications has been discarded. All of these factors are phases of the same condition and therefore the proper method of management should be based on the same basic principles regardless of the stage of the disease.

A review of 215 cases of diverticular disease has been made. One hundred and eleven surgical procedures were performed, 92 of which were resections. There was a mortality rate of 2.2 per cent for resections. It was found that 92.1 per cent of all patients for whom resection was performed were completely rehabilitated.

We feel that there is justification for more preventive resections in diverticular disease. In many patients with stage 1 or stage 2 of the disease, operation can be instituted under ideal conditions with minimal risk, inconvenience and discomfort.

In cases of acute perforation or formation of abscess, multiple procedures may be required. Usually it is advisable to perform preliminary transverse colostomy and provision should be made for drainage of the involved area. Resection should be performed subsequently. Fistulas can be excised at the time of resection.

In conclusion, it can be said that there are many patients with diverticular disease who would benefit from elective, prophylactic single-stage resections which may be performed under ideal circumstances. These may be grouped as follows:

1. Patients with diverticulosis who have mild symptoms or none at all, but in whom complications are likely to develop.

2. Patients who have suffered one or more episodes of acute diverticulitis in spite of good medical management. Included in this group are patients with mild chronic diverticulitis which occasionally causes disability.

3. Patients with diverticular disease who present urinary symptoms.

4. Patients in whom carcinoma cannot be excluded.

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