

DIVERTICULAR DISEASE OF THE COLON

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SPREADING PERITONITIS

A spreading peritonitis as a result of diverticulitis may result from 1 of 3 pathological processes:²²

1. Free perforation of a diverticulum with little macroscopic evidence of diverticulitis.
2. Rupture of a pericolic abscess.
3. Spreading peritonitis associated with acute diverticulitis, but no visible perforation or pericolic abscess.

MacLaren²² has emphasized the importance, prognostically, of the faecal peritonitis associated with free perforation of a diverticulum, compared with the purulent peritonitis in the other 2 groups. All 20 of his patients with free perforation and a faecal peritonitis were profoundly shocked and the mortality was 75%. In the other 2 varieties the mortality was in the region of 30%.

In this series, 11 patients had a spreading or generalized

TABLE III. SPREADING PERITONITIS

Case	Sex	Age	Treatment	Result
Free perforation:				
1	M	69	Suture, drainage, colostomy	Died after 24 hours
2	F	47	Conservative	Recovered
3	F	72	Suture, drainage, colostomy	Recovered
4	M	66	Suture, drainage, colostomy	Died after 2 days
5	M	46	Suture, drainage, colostomy	Recovered
6	F	64	Suture, drainage, colostomy	Recovered
Ruptured pericolic abscess:				
7	F	79	Conservative	Died
8	M	32	Colostomy and drainage ..	Recovered
9	M	55	Colostomy and drainage ..	Died
Acute diverticulitis with spreading peritonitis:				
10	F	65	Conservative	Died after 24 hours
11	M	47	Drainage only	Recovered

peritonitis. All 3 of MacLaren's groups are represented, but the numbers here are too small to permit valid statistical comparison. The cases are summarized in Table III.

1. Free Perforation

There were 6 patients in this group, of whom 2 died. In all except one who recovered with conservative management, the treatment consisted of suture of the perforation, drainage of the peritoneal cavity, and a proximal (transverse) colostomy. The diagnosis in the conservatively treated patient is, of course, presumptive. She had much free gas under the diaphragm, and subsequent investigations by barium meal and enema revealed only the presence of a gross diffuse diverticulosis. There was no evidence of gastric or duodenal

ulceration. Two of the 3 patients who survived the initial operative treatment proceeded to a staged resection of the sigmoid colon. The third patient (case 5) merely had his colostomy closed. This decision led to a considerable difference of opinion and will be considered again later.

2. Ruptured Pericolic Abscess

Two of the 3 patients in this group died. One of those who died was managed conservatively. The other 2 patients were treated by drainage of the abscess and a proximal (transverse) colostomy.

3. Diverticulitis with Spreading Peritonitis

One of the 2 patients in this group was managed conservatively—she was practically moribund on admission—and she died within 24 hours. The other patient recovered after drainage of the peritoneal cavity only.

Discussion

The overall mortality of the 11 cases was thus 45%. It is important to consider the fatal cases in greater detail in an attempt to explain this high figure.

Case 1. The patient was admitted with a general peritonitis of a few hours' duration. There was free gas under the diaphragm, and the provisional diagnosis was a perforated peptic ulcer. The patient only consented to operation several hours later. At operation there was a perforated sigmoid diverticulum with a faecal peritonitis. The patient died in a state of shock 24 hours later.

Comment: A more vigorous attack on the profound hypovolaemia in these patients is certainly the most important single factor to be considered if we are to reduce the appalling mortality in this type of case.

Case 4. In this patient there was a 5-day delay before the surgeons were called to see the patient, and he died 2 days after the operation.

Case 9. Here there was a 13-day delay before the diagnosis was made and operation performed. The patient was admitted to the physicians with a diagnosis of pyrexia of unknown origin, with minimal abdominal signs. Quiet perforation is, of course, a well-known, if rare, presentation of these cases.²⁶

Comment: These 2 cases illustrate the rôle of continued peritoneal re-infection in producing the high mortality, and our surgical efforts must obviously be directed against this factor.

Cases 7 and 10. These 2 patients were both practically moribund on admission, the first on account of co-incident haemorrhage from oesophageal varices, and the second because the perforation had occurred a week before admission. It is difficult to see how any therapeutic measures could have saved them.

From the lessons learned from these cases, 2 over-riding principles in the management of these cases can be enunciated. The first and most important is the need to combat the profound hypovolaemia in generalized peritonitis, which has been likened in its effects on circulatory haemodynamics to a burn of practically the entire skin surface.²⁷ The second principle

is the prevention of the continued re-infection of the peritoneal cavity, and it is in the surgical measures adopted to accomplish this that there is so much difference of opinion. The procedures available are sutures of the perforation, a proximal diversionary colostomy, or resection of the offending segment.

1. *Closure of the perforation.* It is certainly reasonable to do this if possible, but there are 2 obvious difficulties in effecting it. In many cases it is impossible to identify the actual site of the perforation. Even if the perforation can be found, the edges may be too friable and oedematous to permit apposition by suture. Plugging with a piece of omentum can be employed. This was done in 2 of the above cases. This procedure is naturally not applicable to cases of perforated pericolic abscess.

2. *Proximal colostomy.* The practice of performing a proximal diversionary colostomy is widespread, but many authors have justifiably questioned the rationale and necessity of this procedure. Reference may be made to the paper by MacLaren²² for a comprehensive review of the evidence in the literature for and against the value of a proximal colostomy. It is argued that a transverse colostomy can have no effect in diverting the faeces already contained in the left colon. To overcome this objection, Maingot²³ advised the injection of tetracycline into the distal loop, and Bacon and Valiente²⁴ injected 5 G. of neomycin in 500 ml. of saline into the colon well proximal to the perforation, flushing the solution through the entire length of the colon by manipulation.

3. *Primary resection.* This is a rather startling and heterodox measure, but resection may be mandatory on occasion, e.g. in the rare cases where the perforation is very large or in cases of gangrenous sigmoiditis, with anaerobic cellulitis of the mesentery. A Paul-Mickulicz type of resection with exteriorization is theoretically ideally suitable for an inflammatory lesion, but unfortunately the mesentery of the colon is usually so oedematous, friable and contracted that this technique is impossible.

The concept of primary anastomosis following resection in perforated diverticulitis is a recent and highly controversial one. In 1958 Ryan²⁵ described 4 cases of resection and primary anastomosis in a series of 9, with survival of all. He does not, however, advocate indiscriminate resection in cases of perforation. The patient must be fit enough to stand the procedure, and the lesion must be technically amenable, i.e. it must be localized and mobile. The presence of obstruction and advanced general peritonitis are contra-indications. Ryan feels that there is no reason why peritonitis should interfere with anastomotic sutures and, in addition, early peritonitis will settle if the source of re-infection is removed. He states that the safety of bowel anastomosis depends on local factors, such as the avoidance of tension and strangulating sutures, the preservation of blood supply and meticulous mucosal inturning. The absence of bowel preparation is not held to be a contra-indication.

It seems that the type of case for which Ryan advocates primary resection and anastomosis is mainly, if not entirely, restricted to rupture of a diverticulum with minimal surrounding diverticulitis, that is if his contra-indications to primary anastomosis are strictly observed. This would appear to be the very type of case in which the indications for resection, even at a later stage, are most debatable. It can be argued that rupture of such a diverticulum is an isolated episode, since this type of case has seldom had any previous inflamma-

tory episodes, and that such a patient is no more likely to rupture another diverticulum or develop recurrent attacks of diverticulitis than are the many thousands of people who carry their diverticula asymptotically to the grave.

It was on the basis of this philosophy that case 5 had a closure of his colostomy performed rather than a staged resection of his sigmoid colon. This decision was criticized on the basis of evidence in the literature to the effect that simple closure of a colostomy without resection of the offending segment is followed by a prohibitive incidence of further trouble. Thus Pemberton *et al.*,⁶ reporting from the Mayo Clinic, found further exacerbations in 20 of 29 cases after simple closure of the colostomy. In 1942 Smithwick³ reported an incidence of 45% recurrences with the same procedure. However, most of these operations do not seem to have been performed for the type of case we are considering, but rather for severe inflammatory complications with presumably irrevocable structural changes in the bowel, so that recurrences would be expected after closure of the colostomy. It is felt, therefore, that before a simple closure of colostomy is advised there should be good evidence from the operative appearance of the bowel, from the patient's past history, and from the radiological appearances of the colon, that the pathology was a simple rupture of a diverticulum. The radiological appearances are extremely difficult to assess, as will be discussed in a later section, and it remains to be emphasized that each case must be considered carefully on its merits before a decision is made. It is also worth re-emphasizing that these technical manoeuvres are subsidiary in importance to the vigorous and adequate restoration of blood volume. It is also interesting to note that in MacLaren's series, divided into groups according to the availability of antibiotics of various types, administration of antibiotics had little, if any, influence on the mortality figures.

In the rare cases where resection is mandatory, it seems correct to agree with the more orthodox view of Guy and Werelius²⁶ that, whereas the dangers of resection are probably over-emphasized, primary anastomosis is unwise. A Hartmann's type of operation is a safer alternative.

ABDOMINAL MASS

In cases where a mass, palpable either abdominally or per rectum, is the presenting clinical feature, the differential diagnosis from carcinoma is an important and interesting problem. To quote Colcock and Sass,²⁸ the differential diagnosis is 'easy in most, difficult in some and impossible in a few'.

Since the sigmoid colon is the site of predilection for both diverticulitis and carcinoma of the colon, and since both conditions are reasonably common, the 2 lesions may justifiably be expected to occur together in a fair number of cases. However, figures from the literature are striking in the infrequent coincidence of diverticulitis and carcinoma. Thus Rankin and Brown²⁷ found only 4 cases of carcinoma in 227 cases of diverticulitis, and 4 cases of diverticulitis in 679 cases of carcinoma.

The difficulty in making a pre-operative distinction in some instances is reflected in the experience of several writers. Waugh and Walt²⁹ found the distinction impossible in 25% of 93 cases; 5% were diagnosed as definitely carcinoma, 5% as probable carcinoma, and 15% as equivocal. Laufman³⁰

gave a 29-50% error in diagnosis, and Pemberton *et al.*⁶ found the distinction impossible in 25%.

The criteria available for differential diagnosis are clinical, sigmoidoscopic and radiological.

Clinical

Of the 90 cases in this series, 17 (19%) presented with a mass. This experience is the same as that of Arnheim³¹ in 834 cases. Colcock and Sass²⁸ pointed out that both conditions have the same 3 cardinal clinical features, namely, pain in the left iliac fossa, bleeding per rectum and alteration in the bowel habit, but, in an analysis of 50 cases of each condition, they found significant differences in the incidence of the various clinical features. Thus pain and pyrexial manifestations were 3 times as common in diverticulitis as in carcinoma, whereas bleeding per rectum was 3 times as common in carcinoma. The average duration of symptoms was 3 years in diverticulitis as opposed to 8½ months in carcinoma. A significant figure is that, whereas abdominal tenderness is common in both lesions, rectal tenderness was absent in all cases of carcinoma, but present in 16% of diverticulitis.

In the present series of 17 cases presenting with a mass, these general tendencies are confirmed. Fifteen patients had pain as a prominent symptom, the mass was tender in 14, systemic features of inflammation were present in 13, but rectal bleeding was a feature in only 3. There was an alteration in bowel habit in 14 patients—constipation in 7, diarrhoea in 6, and alternating constipation and diarrhoea in 1. The fact that 2 of the 17 patients (12%) had resections performed because carcinoma could not be excluded, indicates that the general tendencies in a series do not always provide the answer in the particular case, which must naturally be considered on its merits.

Sigmoidoscopy

There are conflicting views on the value of sigmoidoscopy in diverticulitis. Boyden¹³ stated that it provides little diagnostic aid. Waugh and Walt²⁹ found the main value of the procedure to be the exclusion of associated lesions, and that, where radiology could not exclude carcinoma, sigmoidoscopy tended to fail as well. Thus it failed when help was needed most. Many surgeons would agree with this view, certainly in those cases where the actual lesion is beyond reach of the instrument. However, Buie and Jackman³² and Smith³³ found the procedure a definite help and listed 5 signs strongly suggestive of diverticulitis. They are:

1. Limited mobility of a segment normally mobile.
2. Angulation caused by inflammation.
3. Reduced lumen and adherent mucosal folds.
4. Sacculatation of the sigmoid.
5. Visualization of the actual diverticular openings.

One or more of these signs was seen in 66% of 242 cases so examined. Actual diverticula were seen in 35 cases.

Todd³ also found the procedure valuable and, in the acute stage, oedema of the mucous membrane together with an excess of mucus are suggestive signs. In his experience inflammatory signs are unusual distal to a carcinoma. Colcock and Sass²⁸ concurred on this point. The experience of this series supports the view that the main value of sigmoidoscopy is in the exclusion of other lesions. The observation of Todd and of Colcock, namely, excessive mucus, was vividly confirmed on one occasion in this series.

Barium Enema

This investigation is the most important aid in the differential diagnosis between diverticulitic and carcinomatous masses. There are several well-recognized criteria to be used, but none is pathognomonic.

1. *The mucosal pattern* is stressed by Schatzki³⁴ and other authors. Diverticulitis is an intramural but extramucosal lesion; thus the demonstration of preservation of mucosal pattern is of fundamental importance. In carcinoma there is



Fig. 3. Filling defect from diverticulitis. Mucosal pattern intact.

early destruction of the mucosal pattern. Fig. 3 shows a constant filling defect in the sigmoid colon. The mucosal pattern remains intact.

2. *The appearance of the filling defect.* In diverticulitis the constricted area tends to have cone-shaped ends which show some flexibility (Fig. 4), whereas carcinoma has sharply defined margins with overhanging edges, producing a shelf-like defect. The appearances in Fig. 5 suggested a carcinoma and a resection was performed. However, the lesion was diverticulitic, illustrating once more the difficulty in diagnosis in some cases. A long filling defect (Fig. 4) also favours the diagnosis of diverticulitis.

3. *The appearance of the adjacent bowel.* Schatzki³⁴ stated that diverticulitis should not be lightly diagnosed in the absence of demonstrable diverticula, but on the other hand the mere presence of diverticula in the adjacent bowel is not of much importance. When a diverticulum can be seen in the narrowed area, as in Fig. 6, the lesion is most unlikely to be a carcinoma.

Management

The management of patients with pericolic masses was purely conservative in 12 of the 17 cases. Two patients had laparotomies only, one by the gynaecologists, and the other apparently for diagnostic reasons in 1943. The second of these 2 patients developed a further mass 10 years later and was successfully managed by conservative measures on this occasion.

Three patients required definitive operations. In 2 carcinoma could not be excluded and resection was performed; one had a resection and anastomosis with complementary caecostomy, and the other a formal 3-stage sigmoidectomy. The third



Fig. 4. Filling defect from diverticulitis. Note the length of the defect and the cone-shaped edges.



Fig. 5. Filling defect caused by diverticulitis and simulating carcinoma. Note the short length of the defect and the overhanging edges.

patient required drainage of an abscess followed by a transverse colostomy 3 months later when the mass was still palpable. He was followed-up for 14 years after this, resection having been deemed inadvisable because of several myocardial infarctions.

These figures testify to the efficacy of the modern conservative management of the pericolic mass. In 1 patient only (drainage of an abscess followed by colostomy) did the inflammation fail to subside. One further patient, however, has a resection pending because a mass has failed to resolve

completely in 3 months although there are no local or general features of inflammation.

FISTULA FORMATION

In this series of 90 cases of symptomatic diverticular disease of the colon, drawn from the records of this hospital for the last 5 years, not a single case of colo-vesical or colo-cutaneous fistula has been observed. This is in accordance with the trend observed in the literature, and it can reasonably be ascribed to the effective management of the acute episode made possible by the advent of the antibiotics.

In 1917 Telling and Gruner³⁶ found some type of fistula in 19.8% of diverticulitis. In 1938 Gouverneur *et al.*³³ reported an incidence of 38 vesico-intestinal fistulae in 423 cases (11.1%), and in 1940 Arnheim's³¹ figure was 8%. In 1955, Reid and Workman³⁸ found the incidence to be only 1.5% of 266 hospital cases, and in the same year Friesen and Schmidt³⁵ reported that they had encountered only 1 case in 5 years.

Certain features of colo-vesical fistulae are of interest:

1. The vast majority of cases occur in males.^{37,54} The interposition of the uterus and adnexae between the sigmoid colon and the bladder in the female probably accounts for the rarity of this complication in this sex.

2. Pneumaturia is the prominent symptom, and usually precedes the passage of faeces per urethram by a considerable time.^{29,37,54,55}

3. Urinary symptoms often regress to a remarkable extent after the establishment of the fistula, since the bladder appears



Fig. 6. Filling defect caused by diverticulitis. There is a diverticulum within the defect.

to acquire a marked tolerance to the presence of faeces. Ascending urinary infection is rare.⁵⁴⁻⁵⁶

4. Passage of urine per rectum is very rare.^{37,55}

5. Cystoscopy is of more value in diagnosis of this complication than sigmoidoscopy.^{37,54,55}

6. Operation is not always indicated in the management of this complication, particularly in the elderly individual in whom the fistula may cause surprisingly little inconvenience.^{39,56}

7. When operation is indicated, a staged procedure is probably the safest,²⁴ but there are increasing numbers of reports appearing concerning the feasibility and safety of the 1-stage procedure. Nine of 93 single-stage resections reported by Waugh and Walt²⁹ from the Mayo Clinic had sigmoidovesical fistulae. Ormond³⁹ struck a more cautious note in advising single-stage operations in selected cases only.

INTESTINAL OBSTRUCTION

Acute mechanical intestinal obstruction is a relatively uncommon complication of diverticulitis. In this series, intestinal colic was a common symptom, but in only 3 cases was a diagnosis of actual intestinal obstruction made. These cases illustrate 3 possible mechanisms whereby obstruction can be produced by diverticulitis.

The first patient had an acute small-bowel obstruction as a result of adhesions of the small bowel to an area of diverticulitis in the sigmoid colon. The second patient had a large-bowel obstruction rendered acute by faecal impaction in a diverticular stricture at the junction of the descending and sigmoid colons. The acute episode was successfully relieved by enemata. The last patient presented with a small-bowel obstruction. At laparotomy the mechanism was found to be a localized ileus of the coils of ileum lying in juxtaposition to an area of diverticulitis of the lower sigmoid colon. There was no mechanical obstruction by adhesions and the colon was not obstructed at all.

UNCOMPLICATED DIVERTICULITIS

In this series of 90 cases, 39 were coded as diverticulitis and did not have any of the major complications of massive haemorrhage, intestinal obstruction, fistula formation, or perforation with spreading peritonitis or a local pericolic abscess.

The classical picture of acute diverticulitis is well known, and is usually stated to be that of left-sided appendicitis, with pain and tenderness in the left iliac fossa associated with nausea and vomiting. Pyrexia and leucocytosis reflect the systemic manifestations of acute inflammation, and a barium enema in the quiescent stage provides radiological confirmation of the diagnosis. The problem, however, is not quite as simple as stated.

Analysis of these 39 patients shows that the main criterion for labelling a case as diverticulitis was radiological, yet 8 of the 39 patients in this group showed no reliable clinical evidence of diverticulitis in that there was no significant tenderness abdominally or rectally. The remaining 31 patients

all had significant local tenderness and usually also systemic evidence of acute inflammation in the form of pyrexia and/or leucocytosis. These cases therefore raise the important question whether several widely accepted radiological criteria for the distinction between diverticulosis and diverticulitis are indeed valid. The question has far more than academic interest because, in addition to its influence on the management of any particular case, an accurate differentiation has an important bearing on the assessment of the natural history of the condition, and this in turn will reflect on our attitude to the management of the condition in general.

Table IV summarizes the important features of the patients in this group. In the group of 8 patients with no tenderness,

TABLE IV. UNCOMPLICATED DIVERTICULITIS

	<i>Tenderness present</i>	<i>No tenderness present</i>
Pain:		
Nil	0	4
Left iliac fossa	23	2
Lower abdomen	3	1
Upper abdomen	2	0
Generalized	3	1
Pyrexia		
	20	2
Bowels:		
Constipation	15	3
Diarrhoea	2	4
Normal	14	1
Urinary symptoms		
	7	0
Barium enema:		
'Diverticulosis'	5	0
'Diverticulitis'	26	8
Treatment:		
Conservative	24	7
Operative	7	1

4 presented with diarrhoea as the main complaint, and 4 had no abdominal pain whatsoever. The remaining 31 patients all complained of abdominal pain; in 23 (68%) it was situated in the left iliac fossa. Only 2 of these patients complained of diarrhoea and, of the rest, approximately a half were constipated and the other half had normal bowel habits.

In the smaller group of 8 non-tender patients, all the barium enemata were reported as showing the features of diverticulitis. In fact, this was the sole reason for making the diagnosis. Numerous other patients with diverticula and similar symptoms were discarded from the series on the basis of a report of diverticulosis only. It is significant that, of the 31 patients with a reasonably confident clinical diagnosis of diverticulitis, 5 were reported as showing the radiological features of diverticulosis only. The conclusion was thus reached that it was important to review as many of the films as possible, as well as the literature on the radiological diagnosis of diverticulitis.

(To be concluded)