

Emergency Subtotal Colectomy:

Preferred Approach To Management of Massively Bleeding Diverticular Disease

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A 69-year-old woman with a history of hypertension was admitted to the hospital with the sudden onset of bright red bleeding from the rectum after collapsing at home. Except for signs of oligemia the physical examination was unrewarding. Following resuscitation with whole blood, emergency proctoscopy revealed the rectum and lower sigmoid to be full of bright red blood which appeared to be coming from above the reach of the instrument. Emergency celiac and superior mesenteric angiography did not reveal the bleeding point. Barium enema X-ray revealed numerous diverticula scattered throughout the entire colon. An upper gastrointestinal series was normal. Coagulation studies were normal. During the next 8 hours in the hospital the patient continued to bleed despite the administration of six units of whole blood. Nasogastric aspirate contained clear gastric content mixed with bile.

A number of distressing and vexing problems confront the surgeon called upon to treat such a patient for numerous reports have attested to the controversies concerning the frequency of bleeding from diverticulosis, the conservative versus surgical forms of management, and to the risks of emergency operation upon such elderly patients. Because of these problems, a conservative attitude of avoiding operation if possible had been adopted by many.^{1,25,33} Moreover, if forced to operate, the surgeon was often advised to attempt to identify the bleeding point in an effort to limit the extent of the operative procedure. Unfortunately this attitude of procrastination along with futile surgical maneuvers often led to deterioration of the patient's conditions in the face of continued hemorrhage.

Cognizant of these problems and based upon a num-

ber of scattered reports suggesting that emergency subtotal colectomy could be safely performed in such patients, we began to pursue a more aggressive surgical approach approximately 5 years ago. We undertook a prospective study to evaluate emergency subtotal colectomy with ileosigmoidostomy for the management of exsanguinating hemorrhage resulting from diffuse colonic diverticulosis.

Patient Selection. All patients with massive bleeding from the rectum were admitted to the surgical service and after initial resuscitation were promptly evaluated by proctoscopy and barium enema X-ray, in addition to determination of the hematocrit, hemoglobin, white count and a simple screening test for coagulation abnormalities. During this 5-year period (1968-1972) we were able to identify 30 patients who experienced exsanguinating hemorrhage, which persisted following admission and in whom no readily identifiable lesion could be identified other than diverticulosis of the colon.

The mean age of these 30 patients was 65 years; the youngest was 50 years old and the oldest, 75 years. Fourteen patients were 65 years of age or older. Ten patients were men and 20 were women, a M:F ratio of 1:2.

In 25 of these 30 patients, the only lesion demonstrable on barium enema X-ray was diffuse diverticulosis involving the entire colon to a variable degree (Figs. 1, 2). In the remaining five patients, diverticulosis was suspected, but the X-rays were equivocal due to poor preparation of the colon or the patient's inability to cooperate during the examination. In none of the patients was there any clinical evidence of active diverticulitis.

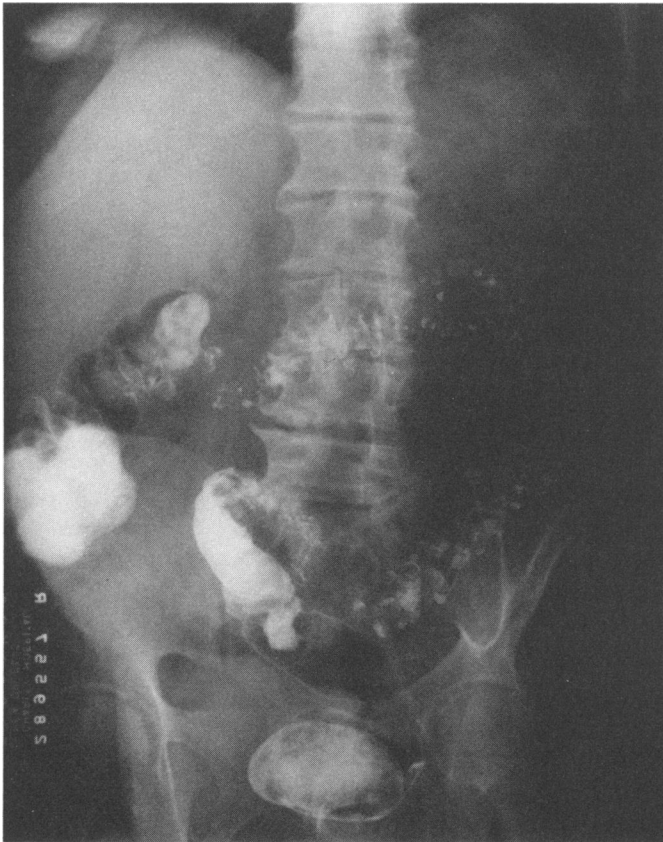


FIG. 1. Emergency barium enema X-ray obtained in a 67-year-old patient with exsanguinating colonic bleeding. Diffuse diverticulosis is evident with involvement of the entire colon. There was no evidence of diverticulitis. Emergency subtotal colectomy with side-to-end ileosigmoidostomy was performed. The patient had an uneventful postoperative course and is now well with no rebleeding. He has two formed bowel movements per day.

In 17 of these patients exsanguinating hemorrhage continued and an emergency operation was performed. In the remaining 13 patients, the hemorrhage was initially controlled only to recur again during the same hospitalization. Other patients continued slow bleeding of sufficient magnitude to warrant an urgent surgical intervention. Table 1 shows the volume of blood administered to these two groups of patients. The mean volume administered was 2,650 ml. in the emergent group and 2,700 ml. in the urgent group. However, there was a wide variation from patient to patient and a number of patients received even larger volumes of whole blood, the largest amount being 15,500 ml.

Twenty-one of the patients (67%) had an associated disease, most common among which was diffuse atherosclerosis, hypertension, diabetes mellitus and congestive heart failure (Table 2). This frequent association of atherosclerosis, hypertension and/or diabetes with bleeding diverticulosis has frequently been noted by others.

In fifteen (50%) of these patients, there was a history

of colonic hemorrhage (Fig. 3). Twelve of these patients had been admitted previously for bleeding diverticulosis which was controlled by medical measures and their present episode represented recurrent hemorrhage. Three additional patients had operation performed for control of colonic bleeding during a previous admission. These procedures included a limited sigmoid resection in two patients and a right hemicolectomy in the third patient.

Operative Procedure. After careful preoperative assessment and determination that hemorrhage was life-endangering, the abdomen was explored through a midline incision. Abdominal viscera were carefully evaluated for other possible causes of hemorrhage, in particular duodenal ulcer, Meckel's diverticulum, intussusception and carcinoma. In most patients this usually revealed the entire colon to be filled with blood and in well over half of the patients there was reflux of blood through an incompetent ileocecal valve into the distal

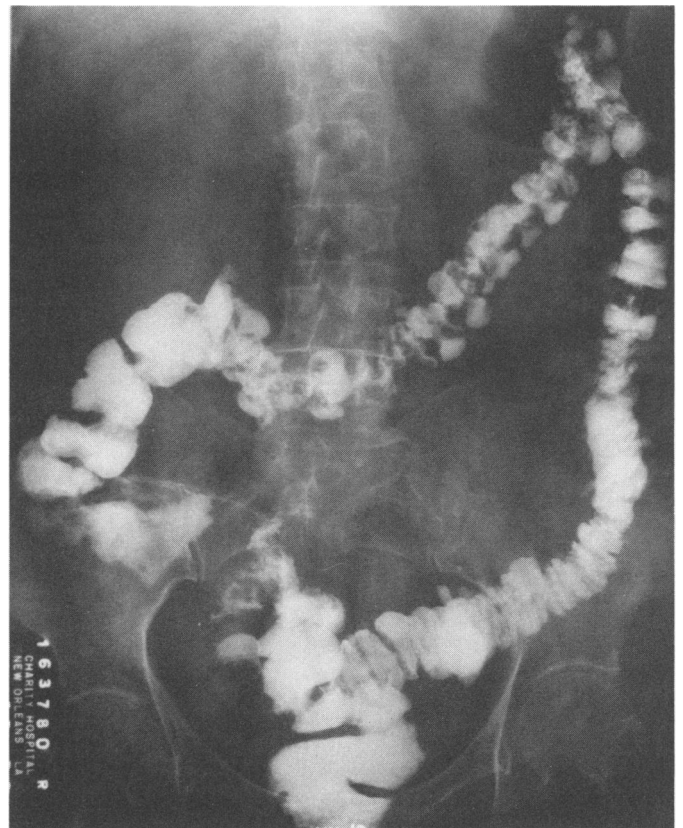


FIG. 2. Barium enema in a 60-year-old woman admitted for exsanguinating hemorrhage. There are various scattered diverticula present in the transverse colon, ascending colon and cecum. This patient also had an emergency subtotal colectomy with complete cessation of bleeding. Postoperative examination of specimen revealed a number of diverticula in the ascending colon with evidence of minute alterations, presumably responsible for the hemorrhage. In this patient, a sigmoid colectomy would probably not have controlled the bleeding. The patient is doing well with no diarrhea.

small bowel. Numerous diverticula involving the colon could be readily identified in all patients. If no other lesion was identified no effort was made to identify the bleeding point by multiple colotomies and operative endoscopy, by isolation of various segments of the colon between non-crushing clamps or by temporary transverse colostomy.

In these circumstances we have proceeded immediately with a subtotal colectomy thereby removing all of the diverticular-bearing area of the colon (Fig. 4). The resection is extended to the distal sigmoid, leaving approximately 20–25 cm. of colon (distal sigmoid and rectum); a primary anastomosis was performed in two layers utilizing the side-to-end ileosigmoidostomy popularized a number of years ago by Baker. Our experience to-date confirms that the latter technic of anastomosis is safer and is more easily performed, avoiding the technical difficulty of an end-to-end anastomosis between the small distal ileum and the larger distal sigmoid which was often quite dilated.

With careful surgical technic and meticulous packing of the pelvis during the anastomosis very little spillage of intraluminal content occurs. The pelvis is then carefully irrigated with copious amounts of normal saline or Ringer's lactate solution and the mid-line abdominal incision is closed in two layers. We have not found it necessary to drain the anastomosis, the pelvis or the wound.

Postoperatively, nasogastric decompression is continued for a minimum of 48 hours or until there is return of peristalsis. Serum electrolytes and fluid balance are carefully monitored and early ambulation is begun.

Initially, some patients had as many as four to six loose or watery stools per day. However, this diarrhea was readily controlled with codeine and/or diphenoxylate hydrochloride (Lomotil®).

We did not encounter a single instance of disabling diarrhea in the 27 patients who survived the operative procedure. Most patients by the time of discharge had one to five semi-solid or formed stools per day with a mean of 2.5 stools per day in the entire group. Only one patient required medication after discharge but this was discontinued after 2 months.

Complications. The postoperative complications encountered are listed in Table 3. In view of the advanced ages of these patients and the emergent circumstances

TABLE 2. Associated Diseases

	No. Patients
Arteriosclerosis	10
Hypertension	9
Diabetes mellitus	7
Congestive heart failure	4
Miliary tuberculosis	1
Chronic renal failure	1
Abdominal aortic aneurysm	1

concerning the operative procedure, the complications were surprisingly few. Nineteen of the 30 patients had a totally uneventful postoperative course without a single complication. In the 11 remaining patients there were a number of complications with three deaths. One patient died of peritonitis from an anastomotic leak which was due to technical error. The second patient was admitted with frank cardiac failure which required correction with digitalis, and blood replacement to restore blood volume. Postoperatively cardiac failure continued and he succumbed to pulmonary edema resulting from acute myocardial infarct. The third death occurred in a patient previously on the medical service with chronic renal failure, uremia and active miliary tuberculosis with positive sputum. Death occurred on the 7th postoperative day from pulmonary emboli and cardiac decompensation complicating uremia and tuberculosis.

Three patients had urinary tract infections which were readily treated with antibiotics and two patients suffered complications of shock including a cerebral vascular accident and acute tubular necrosis in the preoperative period. One patient had a transient period of massive diarrhea suspected to be acute enterocolitis which responded promptly to anti-staphylococcal chemotherapy and volume replacement. All of these patients survived.

In Table 4 are listed the methods of antibiotic treatment in the entire series of patients. Three wound in-

FIG. 3. History of previous hemorrhage from the entire group of 30 patients. In the 15 patients there was no previous history. However, the remaining 15 patients had one or more previous episodes of bleeding requiring admission to the hospital. Twelve of these patients had previously received medical therapy and had stopped bleeding. Three patients (10% of the entire series had previous localized resection of the sigmoid for diverticulosis 4 years, 1 year and 5 months respectively. Bleeding appeared to arise from the remaining diverticula in the unresected portion of the colon.

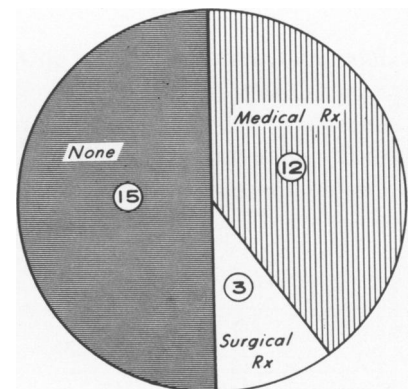


TABLE 1. Blood Transfusions

	No. Patients	Blood* Administered	Range
Emergent	17	2,650 ml.	1,000–4,000 ml.
Urgent	13	2,750 ml.	1,500–15,500 ml.

* Mean

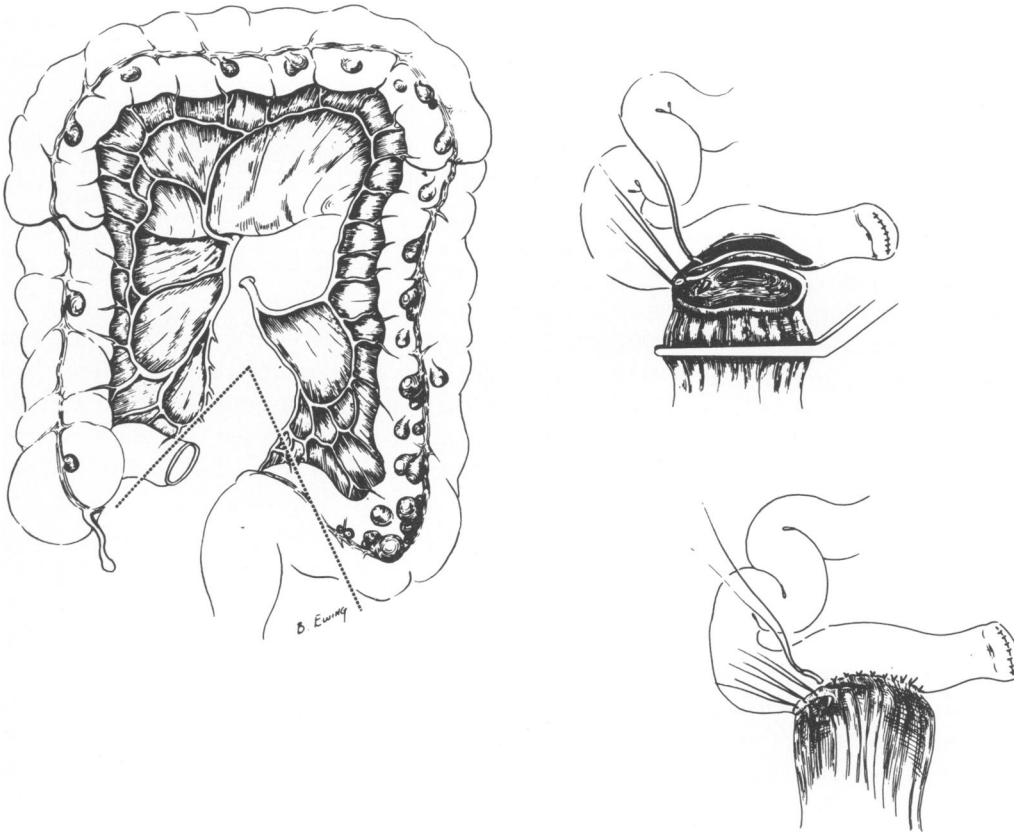


FIG. 4. Operative technic. In instances where multiple diverticular are present throughout the colon, the area of preferred resection is shown. Very little of the ileum is resected, the end of the ileum is turned in and a side-to-end anastomosis is made between the distal ileum and the distal sigmoid in two layers. We have not found the use of drains for the anastomosis or diverting procedures necessary.

TABLE 3. *Surgical Complications*

	No. Patients
Wound infection	3
Urinary tract infection	3
Cerebral vascular accident	1
Pneumonia	1
Pulmonary edema	1*
Prolonged ileus	1
Anastomotic leak	1*
Acute tubular necrosis	1
Enterocolitis	1
Pulmonary emboli	1*

* Death

fections were encountered in the 30 patients postoperatively (10%). Two of these wound infections and one anastomotic leak were encountered in the 17 patients in the emergent group. Obviously, an inadequate period existed for preoperative colon preparation in these pa-

TABLE 4. *Antibiotic Treatment*

	No. Patients	Administered Route	No. Infections
Emergent	17	Systemic	3*
Urgent	13	Oral	2**
Total	30		5 (16.6%)

* 2 wd infections, 1 anastomotic leak

** 1 wd infection, 1 enterocolitis

tients but systemic antibiotics were administered either intraoperatively or for varying periods postoperatively as prophylaxis against infection resulting from operation upon the unprepared colon. However, in the 13 patients listed in the urgent category a sufficient preoperative period existed to adequately prepare the colon with a 24 to 36-hour period, usually with neomycin and sulfathalidine administered in divided doses prior to operation. In the latter group there was one wound infection and one suspected case of enterocolitis. We concluded that preoperative preparation of the colon made little, if any, difference upon the rate of wound infection in these patients. Presumably the diarrhea resulting from hemorrhage produced adequate mechanical preparation despite the presence of large quantities of blood remaining in the colon. Furthermore, in our institution, the rate of wound infection encountered in these patients is similar to our rate of infection following *elective* colonic surgery.

Comments

Based upon the results of this study and upon a number of recent well-documented reports we feel that the following conclusions can be well supported:

Diffuse colonic diverticulosis is now the most common cause of exsanguinating hemorrhage in the elderly patient. During the past three decades there has been a dramatic increase in the incidence of patients encoun-

tered with hemorrhage from diverticulosis. Twenty to 30 years ago, the preponderance of literature reports supported a relative *infrequency* of exsanguinating hemorrhage from diverticulosis. In fact, a number of authors during this period stated that when exsanguinating hemorrhage occurred in the presence of diverticulosis, another lesion such as carcinoma or an ulcerating polyp was probably responsible. However, in a significant review published in 1953, Quinn and Ochsner indicated that during the previous 10-year period at Charity Hospital 37 of 76 patients (49%) admitted for complications of diverticular disease were hospitalized primarily because of hemorrhage, and in 23 of these 37 the bleeding was judged to be of an exsanguinating nature.²³ In the following year, Rives from the same institution reported in a review of 206 cases of massive melena that hemorrhage from diverticular disease of the colon was second only to peptic ulcer of the duodenum in frequency.²⁶

These early reports were supported by Noer in 1955 who postulated after studying colon specimens injected with liquid latex that the hemorrhage was due to the vascularity in the walls of the diverticula. He reasoned that arterial bleeding could result from microscopic ulcerations within these diverticula without visible external evidence of diverticulitis. In a subsequent report he concluded that although cancer of the colon and polyps most frequently caused anemia or mild to moderate hemorrhage, diverticulosis was responsible for *exsanguinating* or *life-endangering* hemorrhage in over 70% of patients so presenting.¹⁹ Similar conclusions were also reached by Earley,⁵ Jensen,⁹ Ross and Eddy,²⁸ Taylor and Epstein³³ and others.

When viewed from the standpoint of the etiology of exsanguinating colonic hemorrhage in a patient aged 50 years and older, it has been our personal experience during the past few years that well over 85% of these patients will be bleeding from extensive diverticulosis of the colon. We have rarely seen massive hemorrhage result from limited diverticulosis or diverticulitis of the sigmoid. Further, there appears to be a direct correlation between the number of diverticula in the colon and the incidence and magnitude of the bleeding, a point which has also been noted by others.

It cannot be inferred that the site of bleeding in the colon is from an area where most numerous diverticula are present or from areas commonly involved with diverticulitis. Although it is difficult to ascertain the site of bleeding even after careful examination of the resected specimen, numerous reports have documented that the hemorrhage occurs with equal frequency from the right side of the colon as compared to the left side. Quinn,²² Earley,⁵ Klein and Gallagher,¹¹ McGuire and Haynes,¹⁵ Salavate²⁹ and others have indicated that in cases in which a source or site of bleeding could be

identified, more than half occurred in the ascending or proximal transverse colon. Therefore, a limited sigmoid resection or even a left hemicolectomy would have failed to control the hemorrhage in over half of the cases. Brasfield has even recommended an empiric *right* colectomy.⁴ In two of our patients in whom a left hemicolectomy was performed to remove "the greater number of diverticula," both subsequently required completion of the colectomy within a few hours after operation when they showed evidence of continued hemorrhage in the recovery room.

It is difficult for the surgeon in the operating room, when faced with a critically ill patient in whom the entire colon is filled with blood, not to associate the bleeding with the well known predilection for diverticulitis to occur in the sigmoid colon. However, now there is overwhelming evidence indicating that there is no apparent correlation between active diverticulitis and hemorrhage. This point can be underscored by the evidence that in none of 30 patients reported in this series could active diverticulitis be identified either grossly or by subsequent pathologic examination of the colon.

Recent efforts to delineate the bleeding point by means of selective superior and inferior mesenteric arterial angiography give further evidence of the lack of correlation between areas commonly involved in diverticulitis and the site of the hemorrhage. In a remarkable recent series reported by Casarella *et al.*, 12 of 13 bleeding colonic diverticula were located to the right of the splenic flexure as determined by selective superior mesenteric angiography.³ This group now feels that selective arteriography is the procedure of choice in attempting to identify the bleeding point but caution that this method is successful only when performed while the patient is actively bleeding. They recommend that angiography should not be preceded by barium studies, since the residual barium in the diverticula will conceal the extravasated contrast medium.

At most institutions, there is insufficient experience at the present time with the use of selective angiography to delineate the bleeding point. Moreover, a number of investigators have indicated that its diagnostic accuracy is not good enough to warrant recommending this time consuming procedure in every patient, but particularly in poor risk patients who are actively bleeding and in whom a quick definitive decision is desperately needed. Our own experience with this method of diagnosis in two of our patients has been unrewarding but with increasing experience in the future this valuable diagnostic technic will probably gain wider acceptance.

Rosch and associates have recommended the selective intra-arterial infusion of vasoconstrictive drugs in an effort to control the hemorrhage, once the bleeding point has been identified by selective angiography^{2,27} and

TABLE 5. *Surgical Treatment for Diverticular Hemorrhage Charity Hospital 1943-1972*

	No. Patients	Re-bled	Deaths
Limited colectomy or ligation bleeding point	23	8	7 (30%)
Subtotal colectomy	35*	0	4 (11%)

* Includes 30 pts. present series

have applied this technic successfully in a few instances. However, recurrence of bleeding appears to be high and insufficient experience exists with this therapeutic modality to recommend its wide spread use at present.

In the presence of diffuse diverticulosis, emergency subtotal colectomy and ileosigmoidostomy is the surgical procedure of choice for uncontrolled exsanguinating hemorrhage. The overall experience with surgical treatment for exsanguinating hemorrhage from diverticulosis in Charity Hospital for the past three decades is shown on Table 5. Quinn reported from this same institution in 1961 the previous 18-year experience with 103 patients with hemorrhage from the colon.²² In 67 of these 103 patients (65%) hemorrhage was considered massive as evidenced by shock, a hematocrit of 30 or less and continued bleeding from the rectum. Of these patients 25 underwent operation, of which only 20 qualified as true emergencies or were done on a urgent basis to control recurrent hemorrhage. In this group there were four deaths, three occurring in the 15 patients who had limited colectomies or ligation of the bleeding point and one occurring in the five patients who had total abdominal colectomies. It was concluded in this early report that prompt resection was the procedure of choice in those patients in whom bleeding could not be controlled by conservative means. However, no conclusions were reached concerning the relative advantages of subtotal colectomy over more limited resections.

Since that report we have encountered eight additional patients who had limited conservative procedures, four of whom died of complications. Our overall 30-year experience therefore indicates that of the 23 patients treated by procedures other than subtotal colectomy, eight patients rebled and there were seven deaths with an overall mortality of 30%. By contrast subtotal colectomy was performed in 35 patients, 30 of whom are reported in this review. There were no instances of rebleeding and only

4 deaths, giving a mortality of 11% for the entire subtotal colectomy group.

Similar experiences have been recently reported in smaller groups of patients subjected to subtotal colectomy. Giffin and associates reported on four subtotal colectomies with no deaths.⁸ Klein and Gallagher¹¹ and Freeark⁷ also performed subtotal colectomy in six patients with no deaths, Olsen had one death in seven patients with subtotal colectomy.²⁰ All of these authors indicated a high incidence of rebleeding and a high mortality in patients who had more limited procedures performed.

In a recent 20-year review, McGuire and Haynes concluded that subtotal colectomy should be the procedure of choice¹⁵ for they were able to find 34 such procedures performed with only three deaths and no recurrence of bleeding.

In Table 6 are depicted the reported comparative results of the various surgical procedures for the treatment of exsanguinating hemorrhage from diverticulosis. We have added our own experiences to the recent literature review reported in 1972 by McGuire and Haynes. These figures similarly confirm a high recurrence rate of bleeding (50%) and a high mortality (19%) for those limited procedures involving either partial colectomy or ligation of a visible bleeding point. By contrast, of the 64 patients who underwent subtotal colectomy (including our 30 patients in this report) there were only 6 deaths with a mortality of 9.4%. When one considers that these operations were performed in critically ill, elderly patients, all of whom had experienced massive blood loss, a 9.4% mortality appears acceptable, particularly in view of the reported *elective* mortality rate in major abdominal procedures in elderly patients which has also been reported by Welch and others to be approximately 7-9%.³⁶

Operative maneuvers to identify the bleeding point are usually futile and hazardous. Recent experience does not support the recommendations of numerous authors for the use of lesser procedures, including operative coloscopy to identify the bleeding point; the isolation of the various segments of the colon between non-crushing clamps in an effort to limit the extent of resection; the use of temporary colostomy or cecostomy; or the performance of multiple colotomies or even "blind," limited resections. Operative colotomies and coloscopies prolong the operation and increase the risk of peritoneal contamination. Kleinfeld and Gump reported their experiences with operative coloscopy in 311 elective operations.¹² Patients in whom coloscopy was used had three times as many wound infections and a higher incidence of intraperitoneal abscesses and fecal fistulas. It seems reasonable to believe that a similar or even higher risk of infection and increased morbidity would follow operative endoscopy in a blood filled, unprepared bowel,

TABLE 6. *Results of Operations Reported 1957-1972*

	No.	Recurrences	Mortality
Colostomy or cecostomy	7	1	3
Partial colectomy or ligation for visible bleeding	64	32 (50%)	12 (19%)
Subtotal colectomy	64	0	6 (9.4%)

a point which has been emphasized by Olsen²⁰ in his excellent review and with which we heartily concur. Others have commented upon additional problems encountered with such ineffective efforts to locate the bleeding point, including increased operative time, continued bleeding and prolonged ileus.

We believe that elderly patients tolerate emergency subtotal colectomy well but they do not tolerate infection produced by gross fecal soilage introduced by multiple colotomies or operative coloscopy. In fact, all four deaths in our eight patients who had procedures other than subtotal colectomy for the control of hemorrhage were due to sepsis. We see no advantage in the anastomosis of the cecum to the distal sigmoid in an effort to control postoperative diarrhea by retaining the ileocecal valve. Not only can the inconstancy of the blood supply to the cecum lead to problems with the anastomosis, but also there is increased risk of fecal contamination in a cecum filled with blood and feces. Furthermore, diarrhea does not appear to be a problem as long as the distal sigmoid and rectum are retained.

Summary

Our 30-year experience in Charity Hospital with surgical procedures for the control of exsanguinating hemorrhage in 58 patients is presented.

Subtotal colectomy as a primary procedure was performed in 35 patients with four deaths (11%). Thirty of these patients have had this procedure performed during the past 5 years with only three deaths in the latter group (10%).

Procedures which attempted to identify the bleeding point or "blind" limited resections were accompanied with a high rebleeding rate (33%) and a high mortality rate (30%).

Considering the advanced age of the patients with this disease, the exsanguinating nature of the bleeding and the associated diseases, complications encountered were few. Sixty per cent of the patients did not experience a single complication. Early postoperative diarrhea was readily controlled by medication and all patients now have regular bowel movements without the need for medication.

Subtotal colectomy with ileosigmoidostomy should be adopted as the operation of choice for the control of exsanguinating hemorrhage from diffuse diverticulosis.

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