

Surgical Management of Acute Volvulus of the Sigmoid Colon *

A Study of 55 Cases

DAVID B. HINSHAW, M.D., RICHARD CARTER, M.D.

Los Angeles, California

*From the Department of Surgery, College of Medical Evangelists, School of Medicine,
the Los Angeles County General Hospital and the White Memorial Hospital,
Los Angeles, California*

THE CURRENT surgical management of acute volvulus of the sigmoid colon has become a matter of controversy since non-operative treatment has been advocated. The enthusiasm for non-operative treatment has largely followed the work of Bruusgard.² However, many surgeons have hesitated to accept non-operative treatment because of the difficulties encountered in determining the presence of strangulated bowel. A true evaluation of this problem has been difficult because most reported series are not sufficiently large to warrant valid conclusions. The largest previously reported series in this country was 25 cases.⁹

DEFINITION AND CLINICAL TYPES

Sigmoid volvulus is the most common strangulating obstruction of the colon, and it is exceeded only by carcinoma as a cause of acute obstruction of the large bowel. It occurs about twice as often as volvulus of the right colon, and in this country it accounts for approximately 2 to 3 per cent of all intestinal obstructions. A lethal disease, volvulus of the sigmoid colon combines simple obstruction of the large bowel with the immediate danger of strangulation and perforation. Its high mortality rate of 25 to 50 per cent in some series attests to its surgical importance.

Volvulus is a twisting of the bowel which produces luminal obstruction and eventually occlusion of its mesenteric vessels.

The clinical picture is chiefly influenced by the rapidity of the twisting of the mesentery resulting in gangrene of the bowel. In view of this, sigmoid volvulus may be divided into two major clinical types. The *acute fulminating type* occurs more frequently in younger patients, and is characterized by sudden onset and rapid course, early vomiting, diffuse abdominal pain, tenderness, and marked prostration. Gangrene tends to develop early due to occlusion of the mesenteric blood supply, and this accounts for the fulminating course. The torsion involves mesentery which is innervated by somatic nerves, and consequently back pain may appear. The sudden, severe, mid-abdominal pain in these patients usually suggests a perforated viscus or other abdominal catastrophe. The following case illustrates the acute fulminating type.

Case 1. J. M., a 43-year-old colored man, was admitted to the Los Angeles County General Hospital on September 3, 1950, with a 12-hour history of cramping lower abdominal pain and vomiting. He had a long past history of intermittent abdominal pain, obstipation, and distention. Laparotomy with detorsion of a volvulus of the sigmoid colon was done in 1942 and again 8 months prior to the present entry. On examination the patient was acutely ill and complained of severe abdominal distress. The blood pressure was 108/70, pulse rate 84, and temperature 36.7° C (98.2° F.). His abdomen was moderately distended and diffusely tender with signs of peritoneal irritation; peristaltic sounds were absent. The white blood cell count was 9,500 with a normal differential. An abdominal x-ray revealed enormous distention of the left colon with a closed loop pointing to the left upper quadrant. At laparotomy 11 hours after

* Submitted for publication October 1, 1956.

admission a sigmoid volvulus was found, and an obstructive resection was done. Although the colon appeared viable at operation, microscopic study of the sigmoid showed areas of mucosal necrosis. The postoperative course was uneventful, and 4 weeks later the sigmoid colostomy was successfully closed.

The *subacute progressive type* is more common, usually occurs in older patients, has a more gradual onset, more often has a history of previous attacks or of chronic constipation, and runs a more benign course. Gangrene develops more slowly in this group and may result from an enormous rise in intracolonic pressure in the closed loop with tension ischemic necrosis. Tremendous distention of the abdomen is usually present in contrast to the acute type in which significant distention may be absent. Vomiting occurs late in the course of the disease, as is generally characteristic of obstruction of the left colon. This absence of significant vomiting is commonly attributed to competency of the ileocecal sphincter mechanism.¹⁰ The slow, insidiously developing obstructions in this group may sometimes be relieved by spontaneous detorsion, and a history of subsiding attacks may be obtained (recurrent volvulus). The subacute progressive type is illustrated by the following case.

Case 2. S. S., an 83-year-old white man, was admitted to the Los Angeles County General Hospital on October 19, 1947, because of cramping lower abdominal pain and vomiting. Increasing abdominal distention with obstipation had been noted for 5 days. On examination the patient appeared acutely ill; blood pressure was 140/80, pulse rate 110, and temperature 36.6° C (98° F). The abdomen was markedly distended, tympanitic, but non-tender; an occasional high-pitched peristaltic tinkle was heard. No masses were palpable. The white blood cell count was 8,000 with 72 per cent neutrophils. A plain roentgenogram of the abdomen revealed marked non-specific gaseous distention of the entire colon, most consistent with low colonic obstruction. The clinical impression was obstruction of the large bowel—due either to volvulus of the sigmoid or carcinoma of the left colon. At laparotomy 4 hours later the sigmoid colon was enormously distended with a 360 degree clockwise rotation. Following decompression and

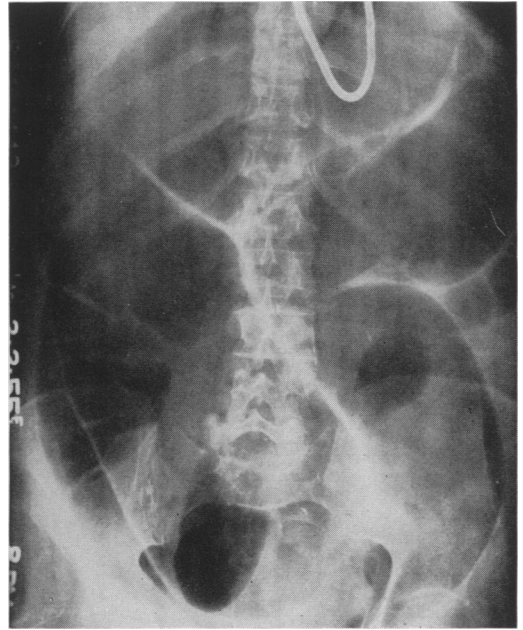


FIG. 1. A supine abdominal roentgenogram showing marked sigmoid loop distention with the bent inner-tube effect.

detorsion of the involved viable sigmoid, an obstructive resection was done. Six weeks later the colostomy was successfully closed.

PATHOGENESIS

There is general agreement that the most important etiologic factor for the volvulus is a redundant sigmoid loop with a narrow base of attachment. This "omega loop" rotates about its mesenteric axis to produce a closed loop type of obstruction. In most cases the upper limb of the loop descends in front of the lower limb, twisting in either a clockwise or counterclockwise direction. A twist of more than 180 degrees causes occlusion of the lumen. Sometimes the sigmoid loop is intertwined with a loop of small bowel, occasionally producing pressure necrosis or obstruction of the small bowel.

In about 75 per cent of cases the ileocecal valve is so competent that no regurgitation is possible, and a double, closed loop obstruction exists. Closed loop obstructions differ basically from simple obstruc-

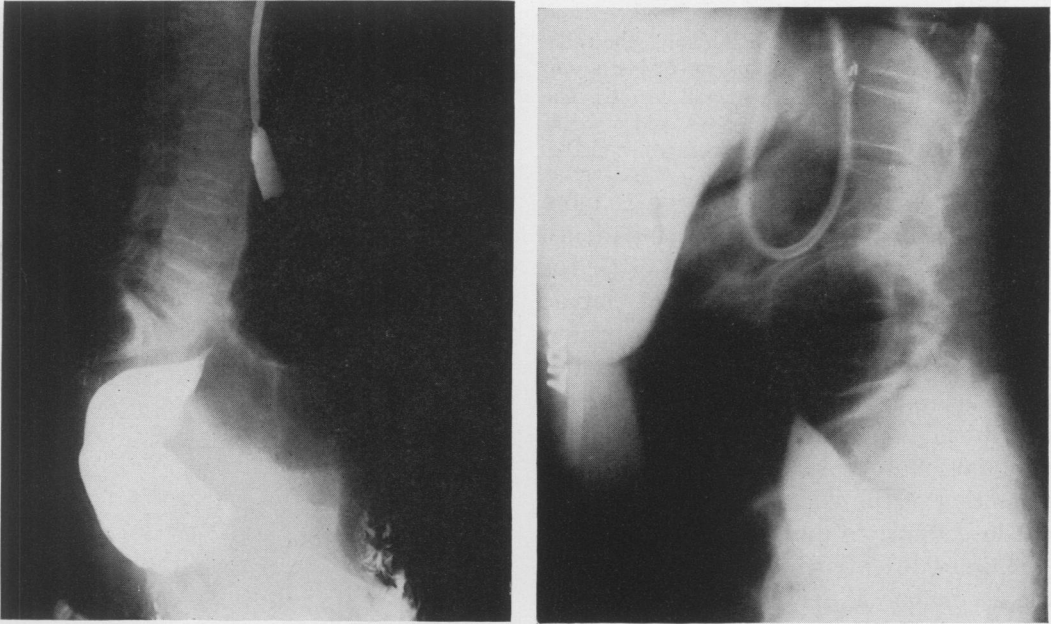


FIG. 2. (A), (B) Barium enema illustrating spiral twist and "ace of spades" deformity.

tions because there is no open proximal end to allow regurgitation.¹ Volvulus of the sigmoid colon with rotary tension obstructing venous outflow is fundamentally a necrotizing mechanism. The vascular changes which arise in the fulminating type with such startling rapidity are due to the tight compression of the mesenteric circulation and to the rapid and immense distention of the rotated bowel loop. Visceral hypertension in the involved loop impairs capillary circulation; submucosal vascular plexuses are particularly vulnerable to the flattening force exerted by pressure within the lumen. It has been shown by Gatch and Culbertson⁶ that the bowel is made practically bloodless when intra-intestinal pressure equals or exceeds the diastolic blood pressure. Ordinarily the veins are occluded first by the strangulating force; the bowel then become bluish-black in color, and occasionally it can be outlined as a tympanitic, semi-rigid mass (Wahl's sign). This venous occlusion produces hemorrhagic infarction of the segment with loss of blood sufficient

to produce shock, particularly in the case of a long loop. Toxins, bacteria, and blood pass through the bowel wall permeating the peritoneal fluid; this forms the basis for peritoneal irritation as seen clinically. Aerobic and anaerobic organisms multiply within this obstructed loop, and the bacterial invasion of the bowel wall is another factor in precipitating death of tissue and perforation. As pointed out by Dennis,⁵ strangulation may cause death either from shock due to loss of blood, plasma, and body fluids, or from peritonitis.

There are, then, two necrotizing mechanisms in volvulus of the sigmoid colon that combine to produce gangrene: obstruction to mesenteric blood flow from torsion-angulation, as frequently seen in the acute fulminating type, and ischemic necrosis from prolonged visceral hypertension, as seen with the subacute progressive variety.

DIAGNOSIS

An appreciation of the significance of the two chief clinical types is important in diag-

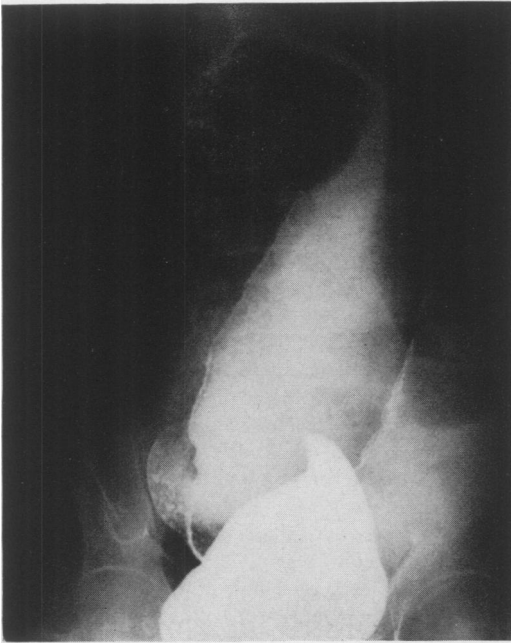


FIG. 3. Barium enema showing "bird beak" appearance.

Chief Clinical Types

	Acute Fulminating	Subacute Progressive
Previous attack	Infrequent	Frequent
Onset	Sudden	Gradual
Clinical course	Rapid, often catastrophic	Slow, but progressive
Pain	Diffuse, severe, often steady	Less marked, occasional cramps
Vomiting	Early	Late, may be negligible
General appearance	Prostration, shock common	Shock, uncommon or late
Distention	Less marked, may be none	Usually extreme
Signs of peritoneal irritation	Usually definite: tenderness, rebound or rigidity	Usually not present
Peristalsis	Violent hyperactivity; later silent	Usual pattern in colonic obstruction
Leukocytosis	Frequent	Infrequent
Roentgen Findings	Frequently not distinctive	Frequently diagnostic
Presence of strangulation	Frequent and early	Infrequent and late
Differential diagnosis	Perforated viscus or strangulated bowel	Obstruction of left colon

nosis and management. The acute fulminating type must be considered in the diagnosis of any acute catastrophic abdominal condition. There are no distinctive diagnostic features of the acute fulminating variety. The clinical picture presented by this type simulates that of a perforated viscus or strangulated bowel and usually leads to prompt exploration. In contrast to this, the subacute progressive type is treacherous and insidious in its development.

The subacute progressive type must be particularly considered in the elderly patient, suspected of obstruction of the left colon, who has extreme abdominal distention. It is around this group that the controversy in management has centered. The difficulty in differentiating between viability and nonviability in acute sigmoid volvulus has been emphasized. This differentiation is academic in the acute fulminating type because operative intervention is mandatory. However, in the subacute progressive variety in which strangulation, if

present, is late and insidious, differentiation may be difficult or impossible. The usual signs of intestinal strangulation such as fever, leukocytosis, and signs of peritoneal irritation may sometimes be absent. The differentiation may also prove particularly difficult in the aged. An analysis of our material suggests that at times it is impossible to determine clinically whether or not the bowel is viable in either clinical type.

It is well recognized that x-ray examination is of vital importance in the diagnosis of volvulus of the sigmoid colon. Actually, however, this is true mainly of the subacute progressive type. It should be possible to make at least a tentative diagnosis of acute sigmoid volvulus from the scout roentgenogram of the abdomen. A large circular dilated loop running from the pelvis, exhibiting a bent inner-tube effect, is most characteristic. Marked distention, increased thickness of the bowel wall, and loss of haustral markings are other important roentgen features. The finding on barium

enema of the spiral twist at the site of torsion is pathognomonic; this twist, depending upon its location, has been referred to as a "bird beak" or "ace of spades" deformity. If the scout roentgenogram is not sufficiently suggestive, one should always get an emergency barium enema.

ANALYSIS OF CASES

This study comprises a series of 55 consecutive cases dating from January 1, 1932, through June 30, 1956. These patients were treated largely by residents under the supervision of the attending staff. Thirteen cases (23.6 per cent) were of the acute fulminating type, while 42 (76.4 per cent) were of the subacute progressive variety. The over-all mortality was 42 per cent. There were 28 cases with 18 deaths (64 per cent mortality) from 1932 to December 31, 1946; from January 1, 1947, to June 30, 1956, there were 27 cases with seven deaths (26 per cent mortality). This improvement of results during the latter part of the series is a reflection of antibiotic therapy, better pre- and postoperative care, and earlier diagnosis. Five were moribund on admission and died before surgical treatment could be instituted; the diagnosis was established by autopsy. The cases have been grouped according to their method of treatment for more detailed consideration.

By treatment failure is meant (1) unsuccessful attempt in passing rectal tube, (2) unsatisfactory decompression after passage of tube, or (3) question as to viability of the bowel.

It should be noted that the four cases were unsuccessfully treated and that they required a subsequent operation during the acute phase.

While observations on four cases do not

warrant far-reaching conclusions, the results suggest that non-operative decompression may not be simple. Even when insertion of the rectal tube is successful, there remains the question of bowel viability. The one death in this group resulted from non-operative decompression for gangrenous bowel (see following case report).

Case 3. L. B., a 70-year-old white woman, was admitted to the Los Angeles County General Hospital on February 3, 1955, because of generalized cramping abdominal pain and vomiting. Abdominal distention and obstipation had been progressive for 3 days. The pulse rate was 90, and the temperature was 38.8° C. (100° F.). The abdomen was severely distended and tympanitic, peristaltic sounds were high-pitched and tinkling, and a succussion splash was noted. The white blood cell count was 24,500 with 80 per cent neutrophils. A supine film of the abdomen demonstrated a bent inner-tube effect consistent with sigmoid volvulus. Non-operative decompression was instituted by passing a rectal tube through a sigmoidoscope. Considerable reduction in the abdominal distention followed. Twenty-four hours later diffuse abdominal tenderness with rebound appeared, and laparotomy was performed. At operation a volvulus of the sigmoid colon with gangrene was found, and an obstructive resection was done. Her subsequent course was one of progressive deterioration, and she expired on March 16, 1955. An autopsy was not obtained.

In this group eight out of 18 cases (44 per cent) were suspected preoperatively of having nonviable bowel, thus making operative treatment mandatory.

By moribund is meant death during operation or within 24 hours. The moribund patient in this group was in an alcoholic stupor on admission and had advanced intestinal obstruction. Another elderly patient in whom clinical signs suggested nonviability of the bowel died three days postoperatively of congestive heart failure.

The third death occurred in an infant in whom spontaneous detorsion was found at

<i>Non-operative Decompression</i>					<i>Laparotomy and Detorsion</i>						
Number of Cases	Vi-able	Non-vi-able	Deaths	Per Cent Mor-tality	Number of Cases	Vi-able	Non-vi-able	Deaths	Per Cent Mor-tality	Moribund Before Operation	
4	3	1	1	25	4	18	17	1	4	22	1

laparotomy but who subsequently died of gangrene of the sigmoid which developed secondary to mesenteric vascular occlusion. That the mesenteric arteries are apt to become thrombosed even after detorsion is a recognized hazard.⁸

The final death was due to recurrence of the sigmoid volvulus during the immediate postoperative period. This re-emphasizes the well-known fact that the recurrence rate is high in this disease and may develop soon after operation.

The basic defects of treatment by operative detorsion are that it is not in itself definitive because it may allow recurrence; furthermore, the possibility of gangrene of the bowel due to unrecognized mesenteric vascular occlusion exists. It is evident that two of the four deaths were errors inherent in this method. The other two deaths were due primarily to associated disease.

Cases treated by exteriorization procedures (Mikulicz) are included as obstructive resections. While the over-all mortality was 41 per cent, it should be noted that the mortality in the cases with nonviable bowel was 75 per cent. Only two of eight patients survived. Excluding patients with gangrene, the mortality was 25 per cent. One of the surviving patients with gangrene was not thought before operation to have nonviable bowel. Non-operative treatment for this patient would have been tragic. The other survivor was thought to have a perforated peptic ulcer, and consequently surgical intervention was prompt.

Further analysis of the six deaths due to gangrene shows that three were in the moribund category on admission. Two died in the pre-antibiotic era due to peritonitis and pneumonia, deaths which might be preventable now. The remaining death in this group followed an error in judgment

(see Case 3) regarding viability of the bowel.

In the non-gangrenous group two patients died of pneumonia, one in the pre-antibiotic period; both were thought to have nonviable bowel before operation. Another died of cardiac arrest at operation and another of coronary occlusion on the seventh postoperative day.

It is apparent that many of the deaths in the obstructive resection group could have been prevented by earlier operative treatment. The present day use of broad spectrum antibiotics and other supportive measures should also materially reduce the mortality.

While the gross mortality of 41 per cent for obstructive resection is high, this figure is misleading. The mortality rate in sigmoid volvulus is directly proportional to the incidence of gangrene of the bowel. Those treated by obstructive resection include the majority of patients with gangrene. Furthermore, obstructive resection was frequently used for treatment failures of other methods. Consequently, it is apparent that the percentage of poor risk patients is much higher in the obstructive resection group.

It is evident that proximal decompression (transverse colostomy and/or cecostomy) has no logical place in the treatment of volvulus of the sigmoid because the involved closed loop is never decompressed. A 100 per cent mortality is the natural outcome of this form of treatment.

TREATMENT

There are two basic objectives in the treatment of volvulus of the sigmoid colon: the first is the relief of the acute colonic obstruction, and the second is the ultimate curative resection of the sigmoid. Any over-

<i>Obstructive Resection</i>						<i>Cecostomy</i>					
Number of Cases	Viable	Non-viable	Deaths	Per Cent Mortality	Moribund Before Operation	Number of Cases	Viable	Non-viable	Deaths	Per Cent Mortality	Moribund Before Operation
24	16	8	10	41	3	6	4	2	6	100	3

all plan of management must provide for the accomplishment of both. Consequently, the plan of management ordinarily calls for two operative procedures. The objective of the first operative stage is to relieve the acute colon obstruction and resect non-viable bowel, if present. The objective of the second stage is either to resect the previously detorsed sigmoid or to close a colostomy remaining from a previous obstructive resection.

The only method which accomplishes both of the above objectives in one operation with maintenance of bowel continuity is primary resection. While primary resections have been successfully performed, long term experience has shown that primary colonic resection and anastomosis in the presence of acute obstruction may be hazardous. Primary resection should probably be reserved for cases of recurrent volvulus of the sigmoid with spontaneous detorsion which are not operated upon during the acute phase.

First stage treatment may be accomplished by non-operative decompression with a rectal tube, laparotomy with detorsion only, or obstructive resection (including exteriorization). The second stage consists of elective sigmoidal resection after preparation of the bowel if it follows non-operative decompression or detorsion at laparotomy. If obstructive resection was originally performed, then the second stage consists of colostomy closure.

There are certain problems presented by each of the first stage procedures. Non-operative decompression as advocated by Bruusgard is not definitive because it is commonly followed by recurrences if elective resection is delayed. In addition, this method is predicated on the idea that it is possible clinically to differentiate between viable and nonviable bowel. A study of our cases suggests that such a clinical differentiation is often difficult, if not impossible.

Laparotomy with detorsion alone is likewise not definitive until followed by resec-

tion of the sigmoid. However, this method usually permits determination of viability of the bowel. Laparotomy and detorsion is appealing because it avoids a temporary colostomy. It is best adapted to the patient who is willing to have prompt elective resection of the sigmoid. However, many times when the acute phase is relieved, definitive surgery is refused. For this reason the recurrence rate is apt to be high in this group.

Obstructive resection accomplishes at once both basic objectives in that the acute colonic obstruction is relieved and the sigmoid is resected. Obstructive resection is obviously mandatory if the sigmoid colon is gangrenous. Although the resulting double-barrelled colostomy is an undesirable feature, it may be closed at a later stage. If serious associated disease prohibits closure, it may be left as a permanent colostomy.

It would appear that the majority of Bruusgard's cases were of the subacute progressive type of volvulus of the sigmoid in which gangrene appears late and is usually due to ischemic pressure necrosis. It is evident that such patients seen early in their disease may frequently respond to non-operative decompression in the hands of those experienced in this method. Most of his patients were seen within 12 to 72 hours after the onset of symptoms, unlike the majority of our cases which were seen at a more advanced stage. He also states that only a small percentage of his patients were in poor condition when first seen, which again is in marked contrast with our series. Bruusgard also admits that the non-operative method is not definitive and that recurrence, consequently, is common. It would appear that the percentage of gangrene in his series is low, although it is not specifically stated. It would seem that several of the deaths in Bruusgard's series were associated with treatment failures. It is probable that some of these deaths were in patients with the acute fulminating type of disease.

Any valid comparison between Bruusgard's mortality rate of 14 per cent and the mortality rates of operative methods must be made only after thorough consideration of such factors as duration of illness, general condition of the patients, incidence of gangrene, and the experience of the operating surgeon with the particular method employed. While the over-all mortality of 41 per cent in our obstructive resection group appears high, it should be noted that one-third of these patients had gangrenous bowel. The incidence of gangrene of the bowel in the laparotomy and detorsion group was 5.5 per cent with an over-all mortality of 22 per cent. In consideration of these factors it is suggested that non-operative decompression in a group of patients such as ours might have been associated with an even higher mortality rate.

We believe that acute volvulus of the sigmoid is a surgical disease and as such should be treated by surgical means. As occasional exception to this rule would be the patient with the subacute progressive type without obvious clinical signs of nonviability whose general condition prohibits laparotomy. On such a patient as this, non-operative decompression with a rectal tube through the proctoscope is justifiable.

It is evident that all cases which show any signs of gangrene of the bowel at operation must be treated by obstructive resection. In those cases which have definitely viable bowel at laparotomy, a choice of procedures exists: obstructive resection, laparotomy and detorsion with insertion of a rectal tube from below and sutured to the perianal skin and, in rare instances, primary resection and anastomosis. While the experienced surgeon will wish to use different methods to suit various situations, it would seem that obstructive resection in less skillful hands would be the safest procedure.

It should be emphasized that the most significant factor in the high death rate in acute volvulus of the sigmoid is the pres-

ence of nonviable bowel. The only factor which can materially reduce this is early operation. Antibiotics, transfusions, and other supportive measures have reduced the mortality in non-strangulating intestinal obstructions. However, these measures do not specifically affect gangrenous bowel for which immediate resection or exteriorization is demanded.

Recommended Plan of Management for Acute Volvulus of the Sigmoid

- I. Early surgical intervention is the safest course.
- II. If bowel is nonviable:
 - a. Obstructive resection (including Mikulicz exteriorization) procedure of choice.
 - b. Primary resection and anastomosis in occasional selected cases.
- III. If bowel is viable:
 - a. Laparotomy and simple detorsion with rectal tube secured to perianal skin—must be followed by subsequent sigmoid resection.
 - b. Obstructive resection—relieves obstruction and accomplishes sigmoidal resection—must close colostomy later.
 - c. Primary resection and anastomosis—seldom advisable in the presence of acute obstruction.
- IV. Non-operative decompression with rectal tube through proctoscope—justifiable in certain poor risk patients whose condition prohibits laparotomy and who have no obvious signs of nonviability of the bowel.

SUMMARY AND CONCLUSIONS

A study of 55 cases of acute volvulus of the sigmoid colon suggests a classification into two main clinical types. The acute fulminating type is characterized by usual occurrence in younger patients, sudden onset and rapid course, diffuse abdominal pain

and tenderness, early development of gangrene, and frequently simulates a perforated viscus or other abdominal catastrophe. The subacute progressive type, which is more common, usually occurs in older patients, has a more gradual onset, runs a more benign course, and develops nonviability of the bowel more slowly.

Acute volvulus of the sigmoid should be considered a surgical disease and as such requires early surgical intervention in most instances. The basic definitive treatment must ultimately be resection of the redundant sigmoid loop. Non-operative decompression with a rectal tube should be reserved for the occasional patient of the subacute progressive type with no obvious

clinical signs of nonviability and whose general condition prohibits laparotomy.

At operation all patients with any evidence of gangrenous bowel must be treated by immediate sigmoidal resection or exteriorization. This is accomplished most safely by obstructive resection. If the sigmoid is definitely viable, the surgeon may choose between obstructive resection, simple operative detorsion and, in occasional suitable cases, primary resection and anastomosis.

It should be emphasized that the mortality in acute volvulus of the sigmoid closely parallels the incidence of gangrene of the bowel and the only factor which can be expected to lower this death rate materially is early operative intervention.

BIBLIOGRAPHY

1. Berne, C. J. and J. H. Payne: Diagnosis and Management of Acute Intestinal Obstruction. *Surg. Clin. North America*, October, 1954, p. 1403.
2. Bruusgard, C.: Volvulus of the Sigmoid Colon and its Treatment. *Surgery*, 22: 466, 1947.
3. Dean, G. O. and J. W. Murry: Volvulus of the Sigmoid Colon. *Ann. Surg.*, 135: 830, 1952.
4. Delafield, R. H., K. Hellriegel, A. Meza and O. Urteaga: Sigmoid Volvulus. *Rev. Gastroenterol.*, 20: 29, 1953.
5. Dennis, C.: Current Procedure in Management of Obstruction of Small Intestine. *J. A. M. A.*, 154: 463, 1954.
6. Gatch, W. D. and C. G. Culbertson: Circulatory Disturbances Caused by Intestinal Obstruction. *Ann. Surg.*, 102: 619, 1935.
7. Gerwig, W. H., Jr.: Volvulus of the Colon. *Surg. Clin. North America*, October, 1955, p. 1395.
8. Graham, R. R. and Jessie Gray: The Colon and Appendix, Operative Technique in General Surgery. Cole, W. H., editor. Appleton Century Crofts Inc., New York, 1949, p. 561.
9. Griffin, W., G. Barton and K. Meyer: Volvulus of the Sigmoid Colon. *Surg., Gynec. & Obstr.*, 81: 287, 1945.
10. Wangenstein, O. H.: Intestinal Obstructions. Chas. Thomas, Springfield, Illinois, 1949, p. 301.