

MASSIVE RESECTION OF THE SMALL INTESTINE

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WHEN A SITUATION presents itself, requiring excision of a large segment of small bowel, the "surgeon is confronted with the alternative of allowing the patient to die or resorting to a heroic effort to save the individual by resection."¹ Such cases are never of an elective nature and are encountered so rarely that I quote Holman² to introduce the following report. "The following case history may lighten the anxieties of other surgeons who may have to undertake resection on a heroic scale. At the time of operation imperfect acquaintance with the published work led me to take a gloomy view of the patient's prospects."

CASE REPORT

Mrs. H. C., a female, age 48, entered the hospital on July 7, 1946, in shock complaining of severe pain in the epigastrium which radiated to the back.

The patient had been under treatment for rheumatic heart disease for the past several years and had been confined to bed for most of the time during the past year. For this reason she had recently come to Arizona. Four days before admission the patient had noted epigastric distress with abdominal cramping and diarrhea. On the morning of entrance to the hospital the patient had a sudden attack of severe pain in the epigastrium followed by nausea, vomiting and collapse. When seen by her physician, Dr. Norman Jacobson, she had a blood pressure of 60/40, respiration 32, a pulse rate of 140 and was pale and perspiring. Both lungs were moist, with rales in the bases. Sinus arrhythmia, enlargement of the heart to the left, and a loud systolic and diastolic murmur at the apex was present. The abdomen was distended with marked tenderness over the epigastrium. Bowel sounds were absent. No fluid level could be ballotted or percussed. No involuntary rigidity was present. Rectal and pelvic examinations revealed no abnormalities.

Serum amylase was 17 mgs. (normal 20-40 mgs.) R.B.C. 4,870,000; Hb. 15 Gm.; W.B.C. 10,960; Stab. 14; Seg. 59; Lymph 27; Urine (Voided) albumin 2 plus; leucocytes 2-4; erythrocytes, neg.

Roentgenograms of chest "Suggest old rheumatic heart with left auricular enlargement." Roentgenogram of abdomen—"Liver moderately enlarged, distention of major portion of small bowel. No free air in abdomen."

Clinical Diagnosis. Mesenteric thrombosis.

Operation. Under general anesthesia left paramedian incision was made, and on opening the peritoneal cavity a moderate amount of "port wine colored" fluid was found, having a putrid odor. Most of the small intestine was found to be gangrenous. There was no evidence of spillage from the bowel, but there was a good deal of the bloody serous material present in the cul-de-sac. For 14 inches from the ligament of Treitz the jejunum appeared viable. The bowel was then traced distally toward the cecum, and it was found that there was no further viable bowel remaining to the cecum; the cecum itself was discolored and there was some question about whether its circulation was ample. Resection of the entire small intestine with exception of about 14 inches of the jejunum and

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the duodenum was done. The intestine was resected up to the cecum and this area was inverted with three layers of sutures. The portion of the jejunum remaining was then brought to the ascending colon and an end-to-side anastomosis made, using three layers of sutures. The mesentery was tied with #1 plain catgut. The patient withstood this rather well, her condition being maintained by intravenous blood during the operation. The abdomen was closed in layers. One penrose drain was left in the subcutaneous tissue.

Post Operative Diagnosis. Arterial embolism of the superior mesenteric artery with gangrene of the greater portion of the small intestine.

Pathologic Report. Gross: Specimen consists of a portion of small intestine 310 cm. in length. Much of the intestine and attached mesentery are very dark in color, giving the appearance of beginning gangrene. The small blood vessels are filled with blood clot.

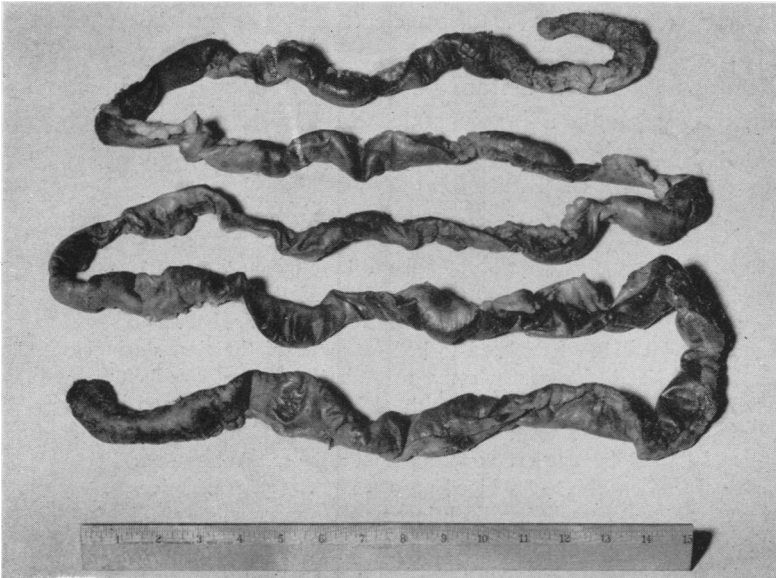


FIG. 1.—Photograph showing the intestine removed at operation.

Microscopic: There is marked extravasation of blood into the tissue of the mesentery. Small blood vessels are filled with organized blood clot.

Diagnosis: Mesenteric thrombosis.

Wangensteen nasal suction, constant O₂, intravenous fluids, transfusions, digifolin and penicillin 20,000 units every three hours were begun. Heparin was instituted on the first postoperative day with exercises on pedals. Nasal suction was discontinued on 7-12-46, on which day she passed several liquid stools. The temperature varied from 99 to 102 degrees the first week, then declined to normal. On 7-14-46 the patient had moderate bleeding from her incision and heparin was discontinued. On 7-15-46, the blood cholesterol was 118 mg./100 cc. (Normal 150-200 mg./100 cc.) The patient was given a high protein, low fat diet and had from four to eight liquid, foul stools daily. On 7-26-46 it was observed that the patient had mild carpopedal spasm. On the same day the blood calcium was 7.7 mg. per 100 cc., a plasma protein was 7 Gm. per 100 cc., and a glucose tolerance test was normal. Calcium gluconate with viosterol was instituted with rapid subsidence of the carpopedal spasms. Ambulation was started on 7-16-46. The patient was discharged from the hospital on 7-31-46, having four to six liquid bowel movements daily.

RESECTION OF SMALL INTESTINE

The patient gained strength and returned to her home in Ohio in September 1946. A letter dated January 20, 1947, from the daughter who is a graduate nurse, states "The patient has been in the hospital three times since leaving Tucson. Her first visit was in October with the diagnosis of acute myocardial failure. Three weeks later with acute myocardial failure, pneumonia and pulmonary edema. Her third trip was last week for four days. I don't know what the last diagnosis was, but she coughed a lot and expectorated a lot of frothy bright red blood for the first two days. Between visits to the hospital she had been out of bed, knitting, etc. She weighs between 95 and 100 pounds.

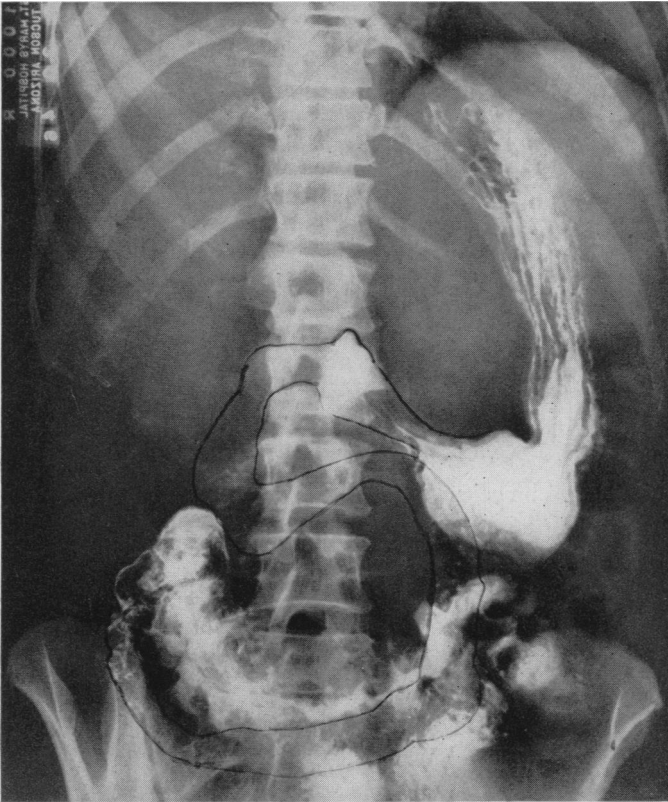


FIG. 2.—Postoperative x-ray film, taken on July 30, 1946, showing length of small intestine remaining. The film is retouched for clarity. Due to rapid passage of barium it was necessary to superimpose another film to determine the exact outline before retouching.

Her appetite is excellent. She eats every four or five hours when awake. She has a partially formed stool each morning and about four hours after each meal, the latter stools are loose and frothy in appearance."

COMMENT

The term "massive" when applied to resection of the small bowel is indicative that the amount of intestine removed measures 200 cm. or more. The majority of reports on this subject which have appeared in the literature have

emphasized the amount of intestine removed. Little or no mention has been made as to the amount of bowel remaining to carry on the absorption and digestion for maintaining nutrition, yet this is the most important factor to be considered. This omission becomes more obvious when it is considered that the small bowel varies considerably between the races, the individual's diet, and the sexes. Bryant³ found that the small intestine's length varied from 10 feet (304 cm.) to 28 feet 4 inches (863 cm.) in adults. It is shorter in women than in men and relatively longer in children. The Japanese and Russians, who eat coarse foods have longer intestines than races eating meats and more refined foods.

There are many reports of massive resection reported, beginning with Koeberle in 1880, with recovery of the patient (quoted from Haymond). Haymond made a thorough review of 257 cases of massive resection and found that the mortality was 33.5 per cent but concluded that this did not represent the true mortality because of the tendency to report only the successful cases. He concluded after studying these cases that a patient can withstand a resection of 33 per cent of the length of the small intestine with the expectation that the digestive tract will return to normal function; 50 per cent removal constitutes the upper limit of safety in extensive enterectomy and resection of more than 50 per cent must necessarily yield poorer results even though an exceptional case may do better than predicted. Sarnoff⁴ states that the removal of 80 per cent proves fatal. In the case herein reported about 80 per cent of the small bowel was resected with survival.

The small intestine is the chief portion of the alimentary tract from which food stuffs are absorbed. No significant absorption occurs in the colon. The jejunum absorbs more fluid and sugars and the ileum absorbs the major portion of the digested proteins and fats. When a large segment of small bowel is removed compensation takes place in several ways. Flint⁵ performed long enterectomies on dogs and found that the remaining portion did not grow in length but increased in diameter to twice the previous size. There was no regeneration in the crypts or villi, but an increase of 400 per cent in the absorbing surface was found. The villi are more numerous in the duodenum and jejunum, and in these regions the absorption rate is also the greatest. The surface area of the intestine, averaging one half square meter, is increased almost to 10 meters by means of these projections.⁶ It is stated by Sarnoff that compensation for resection of the ileum is aided by an increase in gastric secretion, and gastric digestion lasts two hours longer. In our case 50 per cent of the barium was retained in the stomach after the remainder of the barium meal had advanced as far as the sigmoid. Wildegans⁷ found that fats and proteins were not well digested during the first four weeks in dogs after resection of two-thirds of the intestine, but that the animals later regained this ability to a certain extent.

Metabolic studies were made by West et al^{8, 9} of a man with all but three feet of small intestine resected. It was observed that carbohydrates were as well utilized as in normal individuals; 75 per cent of the protein and 55 per

cent of the fat were metabolized. The fecal fat consisted of 80 per cent fatty acids which indicated a good degree of digestion, but a considerable part of this may have occurred after the fat had reached the large intestine in which case it wouldn't have been absorbed. When a high fat diet was given, only 38 per cent of the fat was utilized and the patient developed a negative calcium balance manifested by tetany and a low blood calcium. The large amount of free fatty acids in the stool apparently carried the calcium away in the form of a calcium soap. It seems unlikely that these soaps would be absorbed except in the lower intestine since a significant degree of saponification would not occur in the usually acid contents of the duodenum and upper jejunum. Cosh¹⁰ recorded a case of massive resection with achlorhydria who later developed tetany. He believed the anacidity was an important factor since the absorption of calcium which occurs primarily as calcium chloride in the upper intestinal tract is favored by an acid medium. West et al., noted a negative phosphorus balance in their patient; this could be accounted for on the basis of poor calcium absorption. On a high carbohydrate, low fat diet and a high calcium and vitamin D intake the phosphorus and calcium were brought into positive balance. In a case studied by Dragstedt, described by Haymond,¹ with only 55 cm. of small intestine functioning, it was found that a normal chloride balance was maintained. In our case a low blood cholesterol was present which was probably related to the inefficient lipid absorption. No reports have been found which compared the absorption and digestion within retained segments of ileum with those in which only jejunum remained intact. The greatest number of reports available for study neglected to state which portion of the small intestine remained after resection and this is an important factor in prognosis. A higher percentage of patients should show inanition if the upper segments (jejunum and/or duodenum) are removed than if the lower segments are resected. It is logical to assume that resection of the ileum is more often demanded than that of the upper small intestine. The lower bowel is much more liable to become involved in a volvulus (the most frequent reason for massive resection) and the same portion of intestine is more frequently affected by arterial emboli due to the fact that it receives its blood supply from the lower portion of the superior mesenteric artery where emboli are more likely to lodge. Other factors affecting prognosis are the length of the bowel remaining, its degree of compensatory reaction, the disease which necessitated its removal and the resistance of the patient.¹¹⁻¹² Inadequate compensatory changes following massive resection of the small bowel result in a loss of weight, anemia, diarrhea, edema, tetany, weakness (potassium loss?) and possible vitamin deficiencies.

SUMMARY

A case of massive resection of the small intestine has been reviewed, in which no more than fourteen inches (35 cm.) of the jejunum was left remaining, with survival of the patient. She has manifested the same symptoms and findings as other such reported cases, namely poor fat digestion with frequent

fatty stools, associated low cholesterol and deficient calcium absorption. The carbohydrates and proteins were well metabolized. There was good response postoperatively on a high protein, high carbohydrate, low fat diet augmented by oral calcium and vitamin D.

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