THE SURGICAL MANAGEMENT OF CHRONIC RECURRENT INTESTINAL OBSTRUCTION DUE TO ADHESIONS*

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ONE OF THE MOST DIFFICULT PROBLEMS the internist and surgeon are called upon to manage is the patient who has been subjected to several laparotomies for the lysis of adhesions causing recurrent intestinal obstruction. As a rule after each operation the situation grows progressively worse following a transient period of improvement. Many of these patients become "intestinal cripples" and some become addicted to morphine in order to alleviate the chronic abdominal pain.

Boys[1] in 1942 critically evaluated the many methods recommended for the prophylaxis of peritoneal adhesions. He found all of the methods unsatisfactory with the exception of the intraperitoneal instillation of heparin. He pointed out, however, that although the method was effective in animal experiments, clinical experience was limited to 14 patients, one of whom died postoperatively from a massive intraperitoneal hemorrhage. We are familiar with the data on another patient in whom the outcome was fatal (22 hours postoperatively) due to a massive intraperitoneal hemorrhage.

More recently Bloor and his associates[2] carried out an extensive series of experiments on rabbits in an attempt to evaluate the effect of heparin in controlling the formation of adhesions and reformation of adhesions following lysis. They concluded that heparin was not effective from either viewpoint and further that many of the rabbits succumbed as a result of intraperitoneal hemorrhage and also hemorrhages into vital organs.

In view of the rather hopeless attitude of the profession towards the solution of the problem of recurrent adhesions, it is remarkable that an almost unrecognized and little known method of management has been available since 1937 when Thomas B. Noble, Jr.[3] described his operation of plication of the small intestine. He subsequently reported further continued success with the method in 1939, 1942, 1943 and 1945.[4] Although no statistics are given as to the number of cases operated upon for intestinal obstruction due to adhesions Noble states that "no case plicated has had to be reoperated for obstruction or adhesions."

As a result of the experience obtained with the Noble operation of plication carried out on the three subjects to be reported in this paper we believe that this technic represents a significant advance in surgical therapeusis. The basic principle of this operation is that although reformation of adhesions cannot be

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prevented following their lysis, they can be *controlled.* When this is done successfully, normal motility is restored to the small intestine with consequent freedom from pain, resumption of a proper food intake, and adequate absorption of the necessary nutrients. For the technical details of the procedure the reader is referred to the papers of Noble.[3, 4]

CASE REPORTS

Case 1.—Extreme malnutrition and vitamin deficiency because of adhesions. F. S., a 38-year-old white married woman consulted one of us (N. J.) in December, 1945, complaining of a sore tongue, dependent edema, weakness, vomiting, loss of weight (from a normal of 110 to 95 pounds) and abdominal pain.

The patient was well until 1921 when at the age of 14 years she was operated upon for acute appendicitis. Within one month she was reoperated upon for intestinal obstruction due to an intra-abdominal hernia. During the next year she was operated upon three times for lysis of adhesions, being carried out on each occasion for intestinal obstruction.

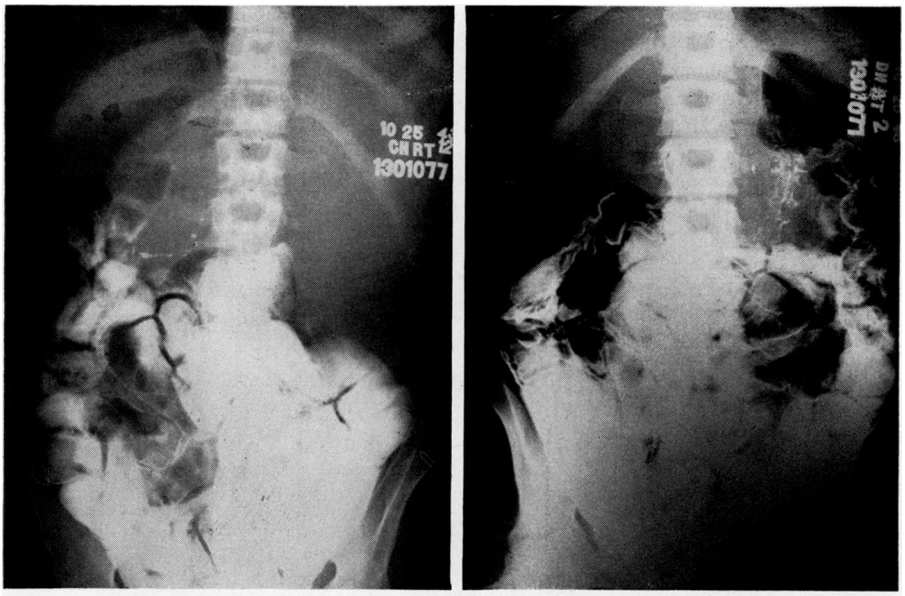
TABLE I.

No.	Date	Operation
1.	June 1921	Appendectomy
2.	July 1921	Exploratory laparotomy—release of an intra-abdominal hernia
3.	August 1921	Ventral hernioplasty—lysis of adhesions
4.	November 1921	Laparotomy—lysis of adhesions
5.	May 1922	Laparotomy—lysis of adhesions
6.	January 1925	Laparotomy—lysis of adhesions
7.	March 1932	Laparotomy—lysis of adhesions
8.	April 1932	Laparotomy—lysis of adhesions and entero-enterostomy
9.	November 1934	Laparotomy—lysis of adhesions
10.	November 1939	Laparotomy—lysis of adhesions and removal of a pelvic cyst
11.	May 1940	Laparotomy—lysis of adhesions and cholecystectomy
12.	June 1942	Laparotomy—lysis of adhesions, and removal of right ovarian cyst and right tube

Two more operative procedures of a similar nature were necessary in 1925 and March, 1932. In April, 1932, in addition to lysis of adhesions an entero-enterostomy was performed. By 1942, 4 more operations were carried out for obstruction and adhesions; in all 11 operations. From 1932 the patient had experienced abdominal cramp-like pain the major portion of each day. By 1938 the patient had become addicted to morphine, necessitating one half of a grain (.03 Gm.) every 2 to 3 hours for control of her pain.

In spite of all these operations the patient's general condition gradually deteriorated (Table I). In October, 1943, the patient was carefully studied in the Mayo Clinic. Gastrointestinal roentgen ray series showed marked delay in emptying of the small intestine (Fig. 1, A and B). The blood calcium was 5.9 mg. per cent, the serum proteins 5.4 Gm. and the plasma ascorbic acid was 0.5 mg. per cent. After one week of intensive nutritional therapy the patient improved and during the next year maintained a fair state of health although the abdominal pain was present daily. In September, 1944, the gastrointestinal roentgen ray series taken at the Mayo Clinic again showed the same delayed emptying time but the blood calcium had risen to 9.8 mg., the serum proteins were 7.3 Gm. and the plasma ascorbic acid was 1.1 mg. per cent. During the next 15 months the patient had many hospital admissions for exacerbations of the intestinal obstruction but these had responded temporarily to gastric suction and parenteral fluids.

At the time of admission here, the patient appeared chronically ill, underweight and debilitated. The abdomen was distended, tympanitic, tender and scarred from 12 previous laparotomies with a ventral hernia, 12 cm. in diameter, covered only by skin and peritoneum



A B

FIG. 1A.—A film taken 4 hours after ingestion of barium by mouth showing dilatation of loops of ileum with delay in emptying.
B.—Six hour film showing marked delay in emptying of small intestine.

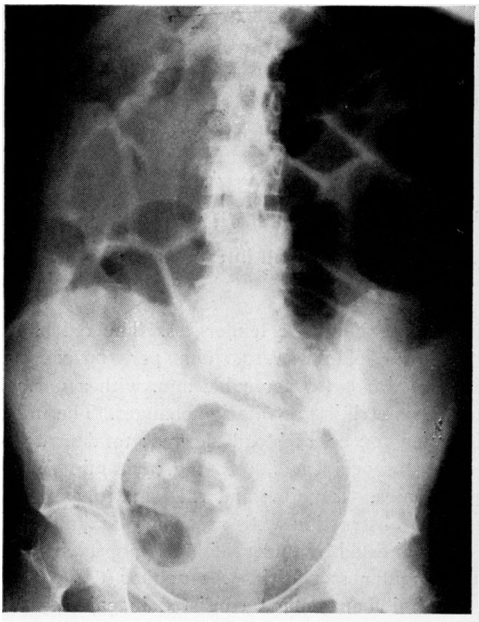


FIG. 2

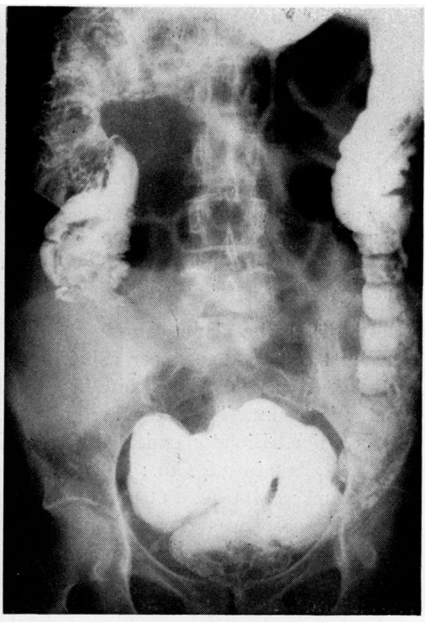
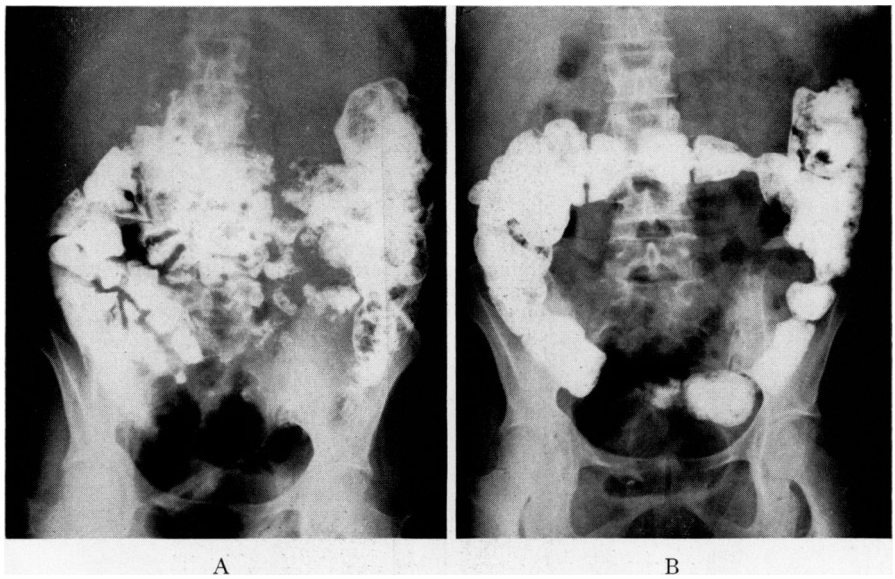


FIG. 3

FIG. 2.—Flat plate of the abdomen showing marked gaseous distention — one week preoperatively.
FIG. 3.—Barium enema demonstrating that the gaseous distention is entirely limited to the small intestine.

through which distended loops of intestine cast their outline. The liver, spleen and kidneys were not palpable; ascites could not be demonstrated; no abnormal masses were felt; digital rectal and bimanual pelvic examinations were negative. Examination for signs of nutritional deficiencies showed the conjunctivae to be thin with only minimal thickening at the equators. Blood vessels of the limbic plexus penetrated a short distance into the true cornea. The angles of the mouth showed both scarring and active fissures. The tongue was thin, completely bald, and showed patches of scarlet-red color at the tip and along the lateral margins. The gums were natural. The skin was slightly dry, tanned, slightly xerotic and showed several ecchymotic areas from accidental trauma. Petechiae could not be produced by the tourniquet test. The extremities showed moderate pitting edema of the feet and ankles. The blood pressure was 120 systolic, 60 diastolic. The heart and lungs disclosed no abnormality. The neurologic examination was normal except for



A B

FIG. 4A.—Gastro-intestinal series carried out 2½ months postoperatively. A film taken 4 hours after the ingestion of barium by mouth showing most of the barium in colon. B.—Six hour film showing all of the barium out of the small intestine and in the colon.

dysesthesia of the plantar surface of the feet, and calf muscle tenderness. The red blood cell count was 3,240,000 per cubic mm., the hemoglobin was 10.0 Gm. per 100 cc., the color index was 1.0. The white blood cell count was 9,000 per cubic mm. with a normal differential count. The stained red cells showed no striking qualitative changes. The urine was negative. Blood chemical determinations per 100 cc. of blood showed: total proteins 5.7 Gm., albumin 3.6 Gm.; globulin 2.16 Gm.; ascorbic acid, 0.66 mg.; vitamin A, 28 micrograms; carotene, 133 micrograms; phosphates, 5.4 units; and calcium, 10.0 mg.

A diagnosis was made of chronic intestinal obstruction with secondary malnutrition of calories, protein, minerals and vitamins as manifested by underweight, hypoproteinemia, edema, glossitis, vascularizing keratitis and angular stomatitis. As neither the patient nor her husband would consider surgery, medical management consisted in cajoling the patient into eating as much of a high caloric, high protein, low residue diet as possible, along with supplements of protein hydrolysates and therapeutic amounts of vitamins by mouth. Folic acid therapy orally and parenterally and refined and crude liver extract parenterally failed to produce a reticulocyte response, a rise in hemoglobin or red cells,

changes in the tongue color or texture, or improvement in the angular stomatitis. On two occasions (February, 1946, and June, 1946) the patient was hospitalized for exacerbations of the intestinal obstruction, which responded temporarily to gastric suction and parenteral fluids. On these two occasions intravenous amino acids, blood plasma and whole citrated blood were given, which was followed by a disappearance of the abnormal red color of the tongue but without evidence of papillary regeneration. Within two weeks of discharge from the hospital, however, the redness of the tongue returned.

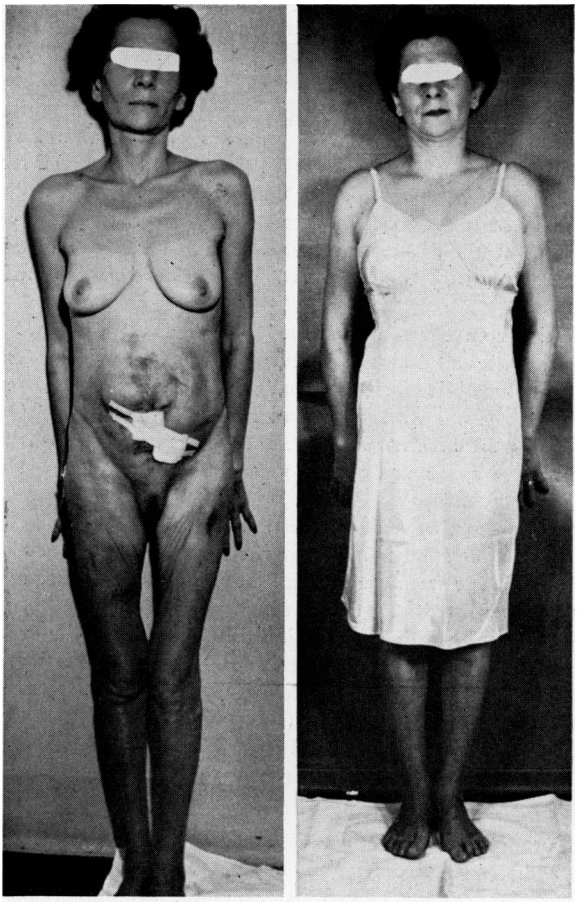


FIG. 5.—A. F. S., about 2 months postoperatively, weight 78 pounds.
B. F. S., 6 months postoperatively, weight 121 pounds.

On September 8, 1946, the patient was readmitted to Doctors Hospital because of an exacerbation of the chronic intestinal obstruction. Examination was essentially the same as previously described, except that she now weighed but 72 pounds and the pitting edema of the legs and sacrum was more extensive. The chemical examinations were approximately those of December, 1945, except that the vitamin A had fallen to 12 micrograms and the carotene to 16 micrograms, showing failure to absorb the large amounts of vitamin

A she had taken by mouth, and failure to either ingest or absorb carotene in her diet. Hyperperistalsis was evident and dilated loops of small bowel could be palpated readily beneath the skin at the site of the hernia. The rectum was empty. Figure 2 shows a flat plate of the abdomen and Figure 3 a barium enema which demonstrated that all of the dilated loops were of the small intestine.

Following several days of gastric suction, parenteral fluids and blood transfusions, the patient was able to take liquids by mouth. At this time the patient and her husband consented to exploratory laparotomy in hopes of being able to use the Noble plication technic. Sulfasuxidine was administered in 2 Gm. doses every 4 hours for 6 days prior to the operative procedure which was carried out on September 19, 1946, by one of us (J. W. L. Jr.). It consisted in the lysis of the entire small bowel which was completely adherent to itself and to the parietal peritoneum. One area of hopelessly gnarled bowel in the region of the previous entero-enterostomy was resected and it was then necessary to carry out two end-to-end anastomoses to join, first, the distal end of the jejunum to the proximal end of a 3-foot loop which entered the gnarled mass and second, to join the distal end of this loop to the terminal ileum. Continuity having been restored, the remaining 7½ feet of small intestine were then plicated with interrupted sutures of cotton from the ligament of Treitz to the ileo-cecal valve, each limb (or wing) of the plication being 6 to 7 inches long. The entire procedure lasted 5½ hours and necessitated a transfusion of 2500 cc. of blood.

The postoperative course was complicated by jaundice for several days during the first week and the incision and drainage of several subcutaneous abscesses from previously self-administered morphine injections. The patient progressively improved so that by the 30th postoperative day she was without edema and weighed 71 pounds. On discharge from the hospital 3 months postoperatively she weighed 100 pounds. A small bowel roentgen ray series was performed approximately 2½ months after operation and showed a normal emptying time (Fig. 4, A and B).

At the end of one postoperative month demerol was substituted for rapidly diminishing doses of morphine and after another month sterile saline was substituted for the demerol. Two weeks before discharge from the hospital the nature of the injections was explained to the patient and she adjusted well to the complete withdrawal.

During the 16 months which elapsed since discharge from the hospital the patient gained another 20 pounds, has remained free from all signs of intestinal obstruction, and all of the signs of nutritional deficiency cleared (Fig. 5, A and B). Menses which had been absent or scanty for several years returned to normal by the second postoperative month and have remained regular. Normal sized loops of small bowel may be palpated easily beneath the skin at the site of the ventral hernia. There has been no resumption of any narcotic or sedative.

Case 2.—Plication done in presence of acute intestinal obstruction. A 13-year-old colored girl was admitted to Presbyterian Hospital in April, 1947. Appendectomy had been performed without drainage 15 months earlier for acute appendicitis. Ten months later acute intestinal obstruction occurred, necessitating an operation for lysis of adhesions. Six weeks before this admission she was again operated upon for acute intestinal obstruction and a loop of gangrenous ileum was resected; again adhesions were divided. Cramps began 48 hours before this admission associated with continuous vomiting. Examination of the abdomen revealed tenderness and distention. A flat plate of the abdomen showed distended small intestinal loops. The Miller-Abbott tube gave poor relief and operation was carried out because the leucocyte count rose to 22,000 and the temperature to 101.2 in spite of hydration.

At operation (done by E. L. H.) the entire ileum and jejunum were adherent. Many kinks were encountered associated with enlarged mesenteric lymph nodes. There was no evidence of gangrene but dilated vessels were present suggesting early inflammatory change. Interrupted silk sutures were used to plicate entire small intestine. Approximately

6 loops (wings) were made 12 inches in length near the ileocecal valve. All sutures were placed at the mesenteric border so that the entire lumen of the intestine was free. Postoperative convalescence was entirely uneventful. A small bowel series on the 11th postoperative day showed normal motility and emptying of the small intestine. The patient has remained well during the follow up period of 8 months. There has been no dietary restriction and she has had one to two stools a day. Some slight pain and nausea have been noted after menstrual periods.

Case 3.—Case with psychotic manifestation, morphine addiction. A 30-year-old trained nurse had an appendectomy for acute appendicitis 10 years prior to admission to the Presbyterian Hospital in May, 1947. A few months following the appendectomy she was operated upon for intestinal obstruction, gangrenous bowel was resected and adhesions separated and divided. Five years later a cholecystectomy was carried out and adhesions lysed. In 1946 the patient was subjected to 3 operations at 14-day intervals for acute intestinal obstruction due to adhesions. Following the last of these procedures the patient had daily abdominal crampy pain, became addicted to morphine and was classified by the psychiatrist as an "intestinal cripple with conversion hysteria." For 2 months prior to admission the patient experienced constant crampy pain, weight loss and scanty menses.

On the 25th of May lysis of the entire small intestine was carried out followed by plication from the ligament of Treitz to the ileocecal valve by E. L. H. There were many angulations of the small intestine, the wall of which was edematous in spots and there were many enlarged mesenteric lymph nodes. During the first 24 hours postoperatively, the patient experienced severe abdominal cramps which stopped immediately on deflation of the balloon of the Miller-Abbott tube. A small bowel roentgen ray series 6 weeks postoperatively showed normal motility and emptying time. Regulation of constipation proved difficult in this case. During the 7 months follow up the patient has had no abdominal pain, has gained 15 pounds and morphine addiction has been relieved. Rehabilitation was slow, difficult but satisfactory.

COMMENT

Although the period of follow up of 18, 8 and 7 months is brief in the three cases reported above, the remarkable absence of any symptoms or signs of intestinal difficulty following the Noble plication procedure in contrast to the continuous ill health for months and years prior to plication is significant. We believe, therefore, that the results obtained with this operation deserve wider recognition and that the technic will find increasing acceptance among surgeons who are called upon to operate for intestinal obstruction due to adhesions. As Noble has stated, it places the surgeon in control of the formation of adhesions instead of allowing them to form by chance with the possibility of obstructions due to kinking and angulation. Plication of the small intestine is not technically a difficult procedure, and requires only a short time to complete after all of the adherent loops have been freed and adhesions divided, but the separation of the adhesions is a long painstaking procedure. Normal function of the small intestine is promptly restored by the operation and the ingestion and absorption of proper nutrients follow, causing the patients to gain weight and lose manifestations of their deficiencies. Two of the three patients became free of morphine addiction, one of eight years and the other of one year, and following the plication procedure both have been free from its use for 18 and seven months respectively.

CONCLUSIONS

1. The plication operation of Noble changes *uncontrolled* adhesions into *controlled* adhesions thereby preventing further attacks of intestinal obstruction due to this cause. A proper nutritional balance is restored, deficiencies clear and pain disappears. The psychotic and addiction states are relieved.

2. The histories of three cases are reviewed in detail to illustrate the great value of the procedure of plication of the small intestine.

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