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ORIGINAL MEMOIRS.

INTESTINAL OBSTRUCTION DUE TO VOLVULUS OR ADHESIONS OF THE SIGMOID COLON, WITH A REPORT OF FIVE CASES, AND A STUDY OF THE ETIOLOGICAL FACTORS.

ONE CASE OF RECURRENT VOLVULUS OF SIXTEEN YEARS' DURATION, THIRTY-TWO ATTACKS, CURED BY RESECTION; SECOND, AN OBSERVATION AT OPERATION, OF ACUTE VOLVULUS SEVEN HOURS AFTER THE ONSET OF SYMPTOMS.

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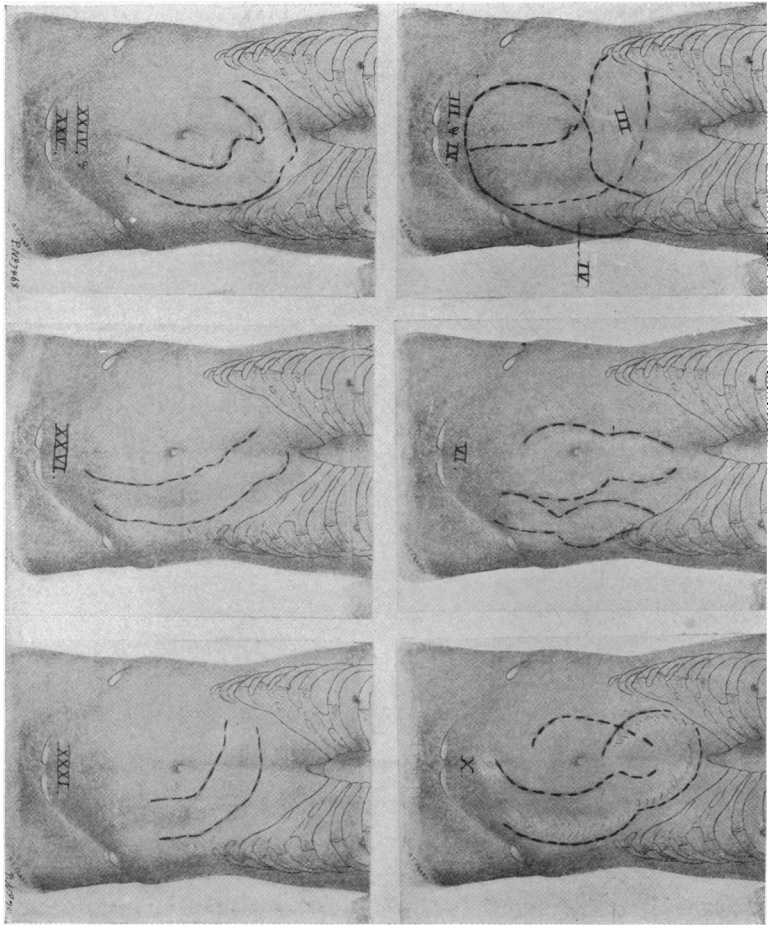
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THE object of this paper is not only to report two cases of volvulus which agree with the usual clinical picture and pathology of this rather rare form of intestinal obstruction, but to call attention to a distinct clinical picture of a more chronic nature which is associated with adhesions in the left side of the abdomen to the sigmoid colon or its mesentery. These adhesions may lead to acute volvulus or to recurrent attacks of abdominal pain or to definite attacks of partial obstruction. From this experience I am of the opinion that there may be a larger number of such cases which are treated for chronic constipation or under the diagnosis of an abdominal neurosis. The patients whom I have observed and whose histories are here reported have been relieved by operative intervention.

The first case (Case I; see Chart 1 and Figs. 1 to 8) has previously been reported before the Southern Surgical and Gynæcological Association ("Transactions," vol. xix, 1906, p. 503). This case is of great interest, because it is an example of recurrent attacks of intestinal obstruction due to volvulus of the sigmoid. We can be certain of the correct diagnosis, because at the first attack the abdomen was opened and the huge twisted sigmoid reduced. In the next sixteen years there were thirty-two attacks. After the last attack the abdomen was opened and the giant sigmoid resected. There were no adhesions, but the mesentery of the sigmoid colon was thickened and the foot points were approximated closer than normal (Figs. 1 and 2). This case is of additional interest as it allowed thirty-two observations on the clinical history and picture of this form of intestinal obstruction. Such an observation is of educational value, as rarely in any large surgical clinic in an equal period of sixteen years has such a number been observed. During this period in Professor Halsted's clinic of the Johns Hopkins Hospital, among 103 cases of intestinal obstruction, there has been but one other case of volvulus of the sigmoid colon. This case (Case 1) is of further interest, as it demonstrates that acute volvulus of the sigmoid colon can be relieved by properly administered rectal enemata in the knee-chest position. It also brings out the fact that relief of a distinct volvulus of the sigmoid by this method or even by laparotomy and untwisting is but a palliative procedure, and that one should look for the cause of the volvulus, a band of adhesions, and, in some cases, should consider primary resection.

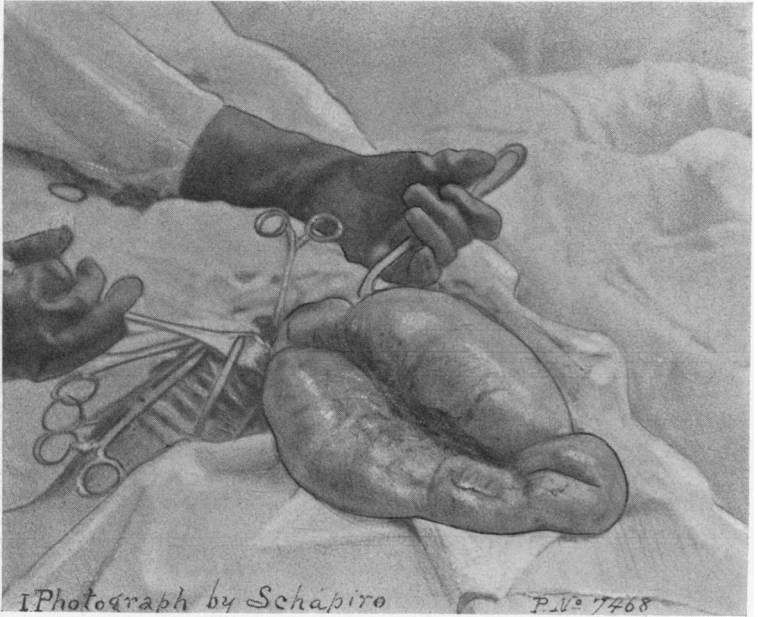
The second case gave me the opportunity to observe the first attack of an acute volvulus, to explore it seven hours after the onset of the first symptom and to find at the operation the band of adhesions which may have been the only etiological factor (Fig. 9). Primary resection was not done, the adhesions only were divided. One cannot look upon this patient as permanently relieved, because it is less than two years since the operation. In the first case reported here

CHART I.



Case I.—Diagrams of peristaltic movements of large bowel, made out at the third, fourth, sixth, tenth, twenty-fourth, twenty-sixth, and thirty-first attacks. Only in the fourth attack does the chart show peristaltic movements in the giant sigmoid. In other attacks this motion is confined to the transverse and descending colon only.

FIG. 1.



CASE I.—Photograph, at operation, of the giant sigmoid colon. No adhesions; the apex of the "U"-shaped bowel reached almost to the ensiform cartilage. This photograph illustrates the approximation of the foot points.

there was an interval of two years between the first and second attack.

In the third case the abdomen was opened five days after the onset of the acute symptoms and forty-eight hours after they had subsided. Nothing definite was found and nothing was done. The history, however, suggested a volvulus of the sigmoid colon, and this patient has been free from further attacks two years and four months.

In the fourth and fifth cases a diagnosis of chronic obstruction of the sigmoid colon due to adhesions was made, and these adhesions were found and relieved at operation.

Further observation may demonstrate that the number of such chronic cases which do not go on to a volvulus with its acute symptoms, are more numerous, and that patients with chronic constipation and recurrent attacks of abdominal pain simulating left-sided renal colic may be relieved of their more or less chronic invalidism by operative intervention, just as to-day we are relieving many patients whose abdominal symptoms are due to chronic appendicitis with which there are no definite acute attacks.

CASE I.—Pathol. No. 7468 (Chart I, Figs. 1 to 8) ; W. M. ; *recurrent volvulus of the sigmoid, thirty-two attacks in sixteen years, resection of giant sigmoid after the last attack, recovery, well two years and four months since operation.*

Clinical History.—This patient was first admitted to the surgical wards of the Johns Hopkins Hospital in January, 1890. The operation was performed in August, 1906, five days after the thirty-second and last attack.

I am able from this case to study the clinical history and physical examination of thirty-two attacks of definite intestinal obstruction, experienced by one patient. The first attack began when the patient was forty-seven years of age. He was admitted to the ward on the seventh day of the attack, and subjected by Dr. Halsted to immediate operation, at which the volvulus was untwisted. After this there was an interval without an attack of two years, when the patient sought treatment on the fifth day of the second attack. The obstruction was relieved by enemata. Seven days later the abdomen was explored by Dr. Finney, who

found a large colon and a large sigmoid still twisted, although the patient had no symptoms. The intervals between attacks in the next four years were twenty, twelve, and sixteen months, the patient seeking relief on the second, third, and seventh day respectively. Relief in each instance was easily accomplished with the rectal tube. From this time on—from 1898 to 1906, a period of nine years—the attacks were more frequent. The longest interval of freedom was nine months, the shortest twenty-four hours. In the years 1900, 1902, 1904, and 1905 there were four or five attacks in each year. It was for this reason that the patient desired relief by more radical means. It is of interest to note that in all, except the first attack, the patient was relieved at once by the passage of the rectal tube. The finding at the second operation,—that the sigmoid was still twisted after an apparent relief from the rectal tube,—may explain the subsequent attacks which occurred twenty-four hours to a few days after the patient left the hospital apparently relieved, and one attack that occurred in the hospital while the patient was in bed a few days after successful treatment with the rectal tube.

When I opened the abdomen five days after the thirty-second attack the sigmoid was untwisted, and there was no obstruction, but I could demonstrate clearly what little force was required to twist or untwist the horse-shoe-shaped giant sigmoid on its thickened mesocolon.

The First Attack.—The patient was then forty-seven years of age. Fifteen years before he had suffered from an attack of typhoid fever without complications. For a number of years he experienced attacks of indigestion at intervals of from four to six weeks. During these attacks his abdomen was distended with gas and he felt nauseated. Further details of these attacks are not given. Three months ago he fell and struck the abdomen, while he was doing some heavy lifting. The present attack is of one week's duration. He had been constipated, when suddenly he experienced general abdominal colic and a constant desire for stool. From the onset there had been no passage of fecal matter or gas. The patient observed a little mucus, but no blood. The abdomen gradually distended. In spite of these symptoms the patient continued to take food and to work. Vomiting began after three days, and has been present off and on ever since. This vomiting is associated chiefly with food or the cathartics which

he has taken. The initial acute pain of obstruction of the small intestine and the primary shock and vomiting were absent, but we have the symptoms of obstruction in the large intestine,—constipation, abdominal colic, secondary vomiting, distention. On admission the patient's condition was good,—the abdomen was uniformly and greatly distended. The operation was performed at once by Dr. Halsted. It is noted that the sigmoid colon was tremendously distended and protruded through the wound. The volvulus was complete; after untwisting, it is noted, the mesocolon was long. Now a rectal tube was introduced which evacuated large quantities of gas and fluid fæces. The wound was closed and the patient recovered without complications.

The Second Attack.—According to the history there was no suggestion of an attack for two years. The symptoms were identical with those of the first attack, except that vomiting began after forty-eight hours—two days earlier; and it is also noted that he had referred pain to the left lumbar region (similar to my more recent observations). He walked to the hospital. The examination showed uniform extension and tympany. With a rectal tube, high enemata and massage, gas and fecal matter were evacuated, and the physical signs subsided. Dr. Finney opened the abdomen seven days later: small intestines adherent to scar of previous median-line incision and a loop of small intestine which was caught, but not obstructed by a band, was first encountered; this band was divided; transverse and ascending colon were larger than normal, and there was a double twist in the sigmoid; this was untwisted, rectal tube passed, which brought away gas and fluid fecal matter.

I wish to emphasize the finding at this, the second, operation. The patient was apparently relieved, yet the sigmoid was still partly twisted.

Recurrent Attacks.—I have carefully read the clinical notes on the subsequent thirty admissions and made charts of the symptom of onset, the subsequent symptoms and the findings at examination (Chart 1). With very little variation each attack is a counterpart of all the others. Colic is the first warning. Now and then this has been preceded one or two days by constipation. On this special fact the history is often silent, but records seem sufficiently clear to demonstrate that during all these years if the patient went forty-eight hours without stool an attack

was sure to follow. In the majority of the attacks one day's constipation was followed the next day by colic and the beginning of an attack. In a few attacks the colic was observed within twelve hours after an apparent normal evacuation. Once the colic appeared the symptoms of obstruction continued until the patient sought relief in the surgical wards by the rectal tube. On a few occasions, a new attack followed relief from an old attack at the hospital with the rectal tube within twenty-four hours.

During the first seven years there were only five attacks, with intervals of from one to two years. In the next seven years there were twenty attacks with the longest interval of nine months. Among these twenty attacks nine were after very short intervals—twenty-four hours to ten days. In the following two years, although there were but six attacks, four of them were after brief intervals of freedom. The attacks, then, were becoming more frequent. As I look upon a short-interval attack as an evidence of incomplete reduction of the volvulus through the employment of the rectal tube and enemata, there is evidence, therefore, of an increasing number of incomplete reductions of the twist.

The duration of the attack from the time of the first symptom to relief varied from twelve hours to seven days. As a rule the patient was sufficiently uncomfortable to seek advice at the end of the third day. During the last three years he came to the surgical wards usually after twenty-four hours, and never waited longer than two days. The patient did this not because he was more uncomfortable, but apparently influenced by our advice and the confidence of getting immediate relief.

The patient never succeeded in relieving himself, although he frequently attempted this with rectal enemata.

The attack, preceded by an interval of constipation, began with general abdominal colic, now and then with pain referred to the lumbar region and back; then with distention of the abdomen, and if he delayed, vomiting. The latter was never a prominent symptom, except in those attacks in which the patient waited three to seven days. At the examination, except on the first two occasions, when the attack had been present five and seven days respectively, the distention was asymmetrical and confined chiefly to the left side of the abdomen, and peristalsis of the transverse and

descending colon could be made out (Chart 1). On not a single occasion was there any evidence of peristalsis of the small intestines. The percussion note was usually tympanitic. When the rectal tube was passed gas was evacuated first, then fluid fæces. The evidence seems to point to the fact that gas was the chief factor in producing the volvulus.

In a few attacks there was slight variation in the symptoms. For example, in one, of forty-eight hours' duration, and in another, of three days' duration, vomiting and colic began together. In the other attacks there was a distinct interval between the onset of the colic and vomiting. With few exceptions vomiting was not present unless the attack was of forty-eight hours' duration or longer. In a few, vomiting was absent even when the colic, constipation and distention had been present from two to three days.

The first vomiting, with few exceptions, began after the patient had taken cathartics himself. When he took no food or cathartics vomiting was practically absent. It was never fecal.

Constipation was absolute in every attack, and in only one it is noted that the patient passed some flatus. Distention with the rarest exceptions began within a few hours after the colic. In one or two attacks there were intervals of one to two days before the patient observed the distention. This is noted only in the early attacks before the patient had developed an acuteness of self-observation. There are two leucocyte counts: one of 18,000 in an attack of three days, and one of 9,000 in an attack of five days. There was never fever, nor retention of urine. The patient's general condition was always good.

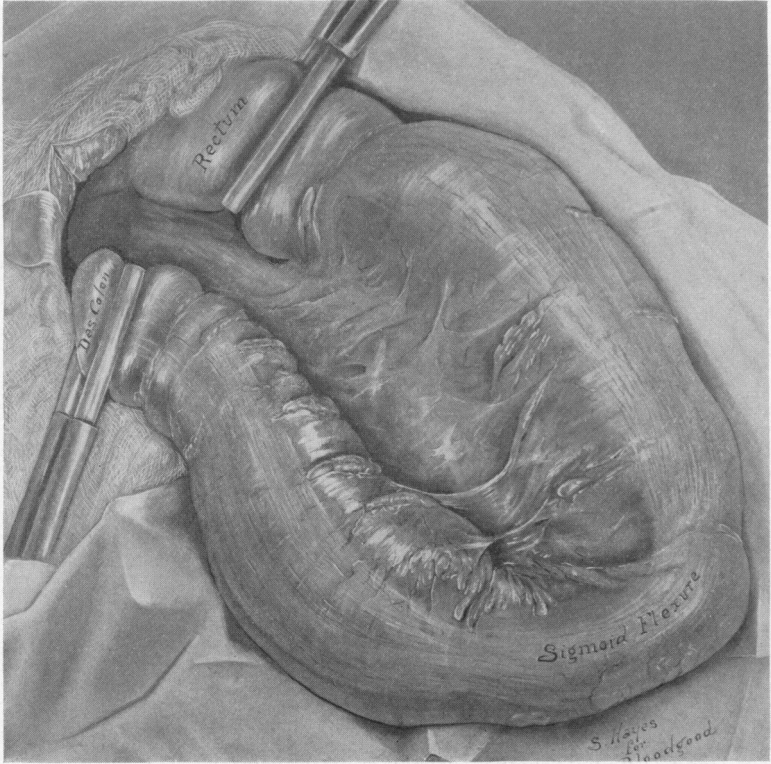
The Symptoms of Volvulus.—From this study we may describe the clinical picture of volvulus as follows:

The patient will give a history of constipation,—the attack begins with colic, as a rule in the umbilical area and the left abdomen, radiating from epigastrium to iliac fossa, with pain sometimes referred to the left lumbar fossa and the back. Pain is never severe like the initial pain in obstruction of the small intestine, or strangulation. The intervals between the pains grow shorter and with this their intensity increases. The character of the pain suggest its relation to peristalsis of the colon, and this is confirmed at the examination, because when one sees the wave of peristalsis the patient complains of pain.

The initial shock of small-intestinal obstruction or strangulation is absent. Initial vomiting is very rare. Following the colic the patient observes distention, chiefly on the left side, and most marked in the lower left quadrant; constipation continues; it is absolute; rarely is flatus passed; vomiting is a late symptom, and usually induced by cathartics or food; belching and hiccough now and then are observed, the latter is infrequent; leucocytosis may be found. At the examination, the distention is asymmetrical and broad peristaltic waves are present in the epigastrium and the left side of the abdomen. The percussion note is tympanitic. The patient's general condition is good, even in attacks of from three to seven days' duration.

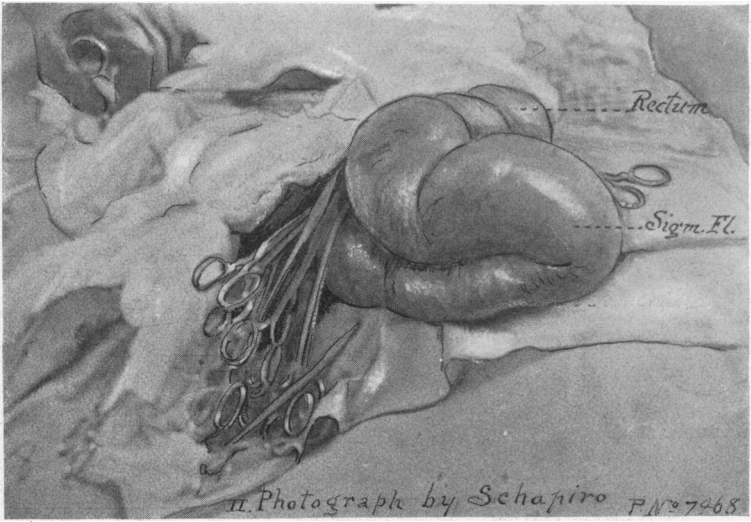
The Mechanism of Volvulus.—In this case there is evidence to indicate that dilatation of the sigmoid colon was present before the first attack. The cause of this cannot be ascertained. We have therefore to explain the mechanism of the recurrent attacks. There is every reason to believe that the sigmoid remained dilated (as shown in Fig. 2 and found at the operation). This dilated colon acted as a reservoir for fæces. I am impressed with the view that fermentation with the formation of gas in the dilated sigmoid colon is the first etiological factor, and careful observation would demonstrate that distention was the first symptom. This loop distended with gas is lifted up into the abdomen, just as the pregnant uterus is forced out of the pelvis by the growth of the fœtus. As the sigmoid rises a kink is produced at its junction with the descending colon, because this portion of the colon is fixed. I demonstrated this at operation. This of itself would be sufficient to produce obstruction and excite peristaltic action of the colon, giving rise to the first symptom observed by the patient,—colic. At this time there is no evidence of a kink in the rectum, but the sigmoid does not evacuate its contents because its walls are overdistended. The exact mechanism of the twist is difficult to establish, but as the dilated sigmoid rises and its upper arm becomes more and more tense on account of its attachment to the fixed descending colon, the lower portion of the sigmoid and the upper rectum, which are less fixed, rise, and as the least resistance is up and to the left, the distended lower portion of the sigmoid and the rectum move in that direction, and the upper portion of the sigmoid is twisted downwards and to the right, while the lower portion moves upwards and to

FIG. 2.



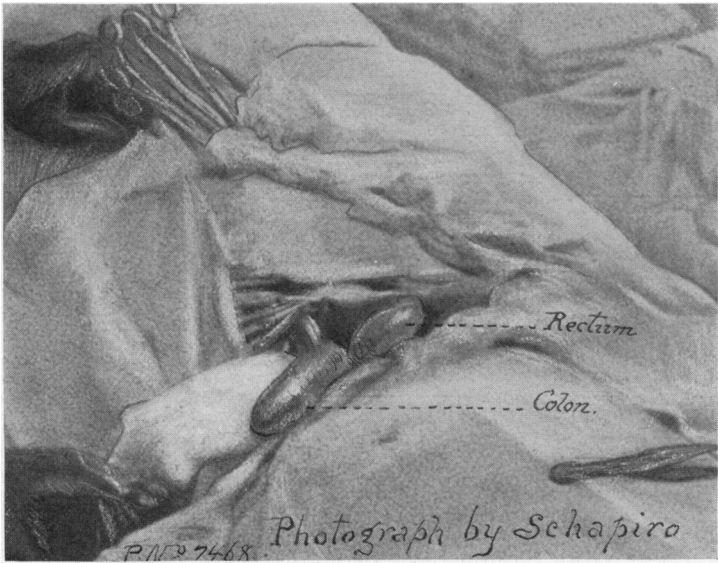
CASE I.—This drawing is made from the photograph (Fig. 1) and the Kaiserling specimen. It illustrates the inflammatory changes in the mesentery, the approximation of the foot points of the sigmoid, and the thickening of the peritoneal coat of the sigmoid colon and rectum. In the lower half of the sigmoid, which is most distended, the longitudinal bands become indistinct.

FIG. 3.



CASE I.—Photograph, at operation, with the clamps on the divided mesenteric vessels and sigmoid. This was performed before the gut was divided.

FIG. 4.



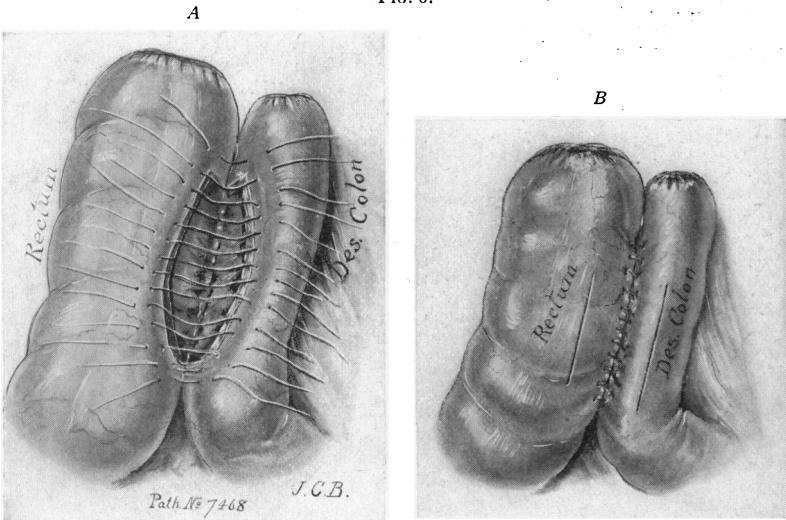
CASE I.—Photograph, at operation, after the removal of the giant sigmoid colon. The closed ends of the rectum and colon are shown projecting from the wound without tension, in a convenient position for lateral anastomosis.

FIG. 5.



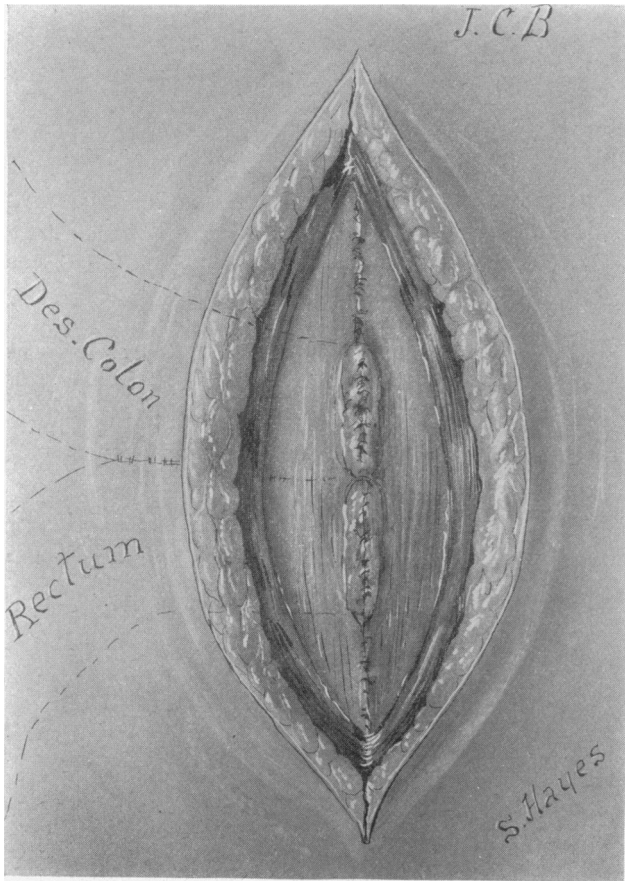
CASE I.—This sketch demonstrates the relation of the inverted stumps of the rectum and descending colon to the mesentery after the removal of the giant sigmoid. In view of the close approximation of the foot points of the sigmoid there was very little folding of the mesentery, and in the mesentery left behind very little evidence of inflammatory changes.

FIG. 6.



CASE I.—Sketch of the method of lateral anastomosis between the smaller descending colon and larger rectum.

FIG. 7.



CASE I.—Sketch of the method of including the closed inverted ends of the descending colon and rectum (Fig. 6 B) in the suture of the parietal peritoneum of the wound.

the left, and the twist is from right to left. This mechanism is also aided by the attachment of the mesentery to the left. The twist kinks the rectum, and we have a double obstruction.

From the notes of the first two operations it can be established with considerable probability that this was the position of the twisted giant sigmoid colon, and at the third operation I was able to twist the sigmoid only in this direction.

The Mechanism of Relief.—The rectal tube has to be forced past the kink in the rectum into the dilated sigmoid. If this is accomplished the gas immediately escapes followed by fluid faeces. On a number of occasions this could be accomplished only with the aid of water distending the rectum in front of the tube. It was found that when the patient was placed in the knee-chest position the rectal tube could be inserted with less difficulty. On a few occasions there was no difficulty whatever in passing the rectal tube, in any position of the patient, while on others it required repeated efforts in the knee-chest position. It seems easy to explain this by a variability in the extent of the twist. When there was little or no difficulty in inserting the rectal tube, the probabilities are that the twist was slight or not present at all, and in the most difficult cases the volvulus was complete.

Findings at the Third Operation.—As the attacks were becoming more frequent the patient quickly consented to an operation which promised permanent relief without too large an element of risk.

On August 2, 1906, under ether narcosis I opened the abdominal cavity through the left rectus muscle. The sigmoid and ascending colon occupied the entire lower left quadrant of the abdomen. There were some adhesions of the small intestines to the abdominal wall in the region of the first laparotomy wound. As these were to the medial side of the present incision they were not disturbed. The patient was placed in the Trendelenburg position. Now, without any difficulty, the giant sigmoid colon was lifted out of the wound and placed upon the sterile towels covering the upper abdomen, as shown in Figs. 1 and 2. The distention of the colon began 10 cm. from the splenic flexure, at the beginning of the sigmoid colon, involved the entire sigmoid and as much of the rectum as could be followed into the pelvis. The rectum below the promontory of the sacrum was covered with a thickened fold of peritoneum extending from the bladder.

All of the peritoneum over the pelvic floor felt thicker and had a more opaque whitish color than the normal peritoneum elsewhere. The mesocolon of the sigmoid was not unusually long and, in fact, rather short as compared with the size of the colon. The appearance of the peritoneum covering this mesocolon was entirely different from the normal peritoneum. It was a thick, opaque, white membrane, and one could not make out the vessels between the folds. The peritoneal covering of the rectum and lower half of the sigmoid colon presented the same thickened, opaque, white appearance. On the sigmoid colon the peritoneum of its upper third was normal in appearance, although the bowel was distended. The distention of the gut increased in diameter from the junction of the descending and sigmoid colon and reached its maximum in the upper portion of the rectum just below the promontory of the sacrum. Below this the distention was less, but the bowel was larger in diameter than the descending colon (Fig. 2). The thickened condition of the peritoneum, both on mesentery and bowel, increased with the distention of the bowel. There were, however, no adhesions.

It was decided to resect, close the two ends by inversion and suture, and then perform lateral anastomosis. The point of resection was chosen in both instances through the bowel at the level of the abdominal wound as the giant sigmoid lay on the upper abdomen, having been placed there with gentle traction only (Figs. 2 and 3). First the peritoneum of the mesosigmoid colon was divided (Fig. 3) at the base between the foot points of the "U," turned back like a cuff, and each vessel separately ligated. Now, when the mesentery was divided there was no hemorrhage, and it could be protected with gauze, while the gut was divided. The division was made between the usual clamps with strong, straight scissors and disinfected with pure carbolic acid. The Paquelin cautery would have been simpler and more efficacious, but unfortunately it was not available at that time. The divided ends of the intestine were inverted with catgut in the usual way. The peritoneum was then again approximated with interrupted fine black silk. The ligated stumps of the mesenteric vessels were covered with a peritoneal suture. The two blind ends of the intestine lay side by side in the lower portion of the abdominal wound (Figs. 4 and 5). A lateral anastomosis was made (Fig. 6, *a* and *b*) beginning 1.5 cm. from the inverted end; their mesen-

FIG. 8.



CASE I.—Photograph of patient, December, 1908, two years and four months after operation.

FIG. 9.



CASE II.—Sketch illustrating the findings at operation. *B*, band of adhesions between the upper third of the sigmoid and the parietal peritoneum of the iliac fossa.

teric surfaces came together to the medial side; a large opening was made. In closing the wound the inverted ends of this anastomosis were placed outside of, and included by, the peritoneal suture (Fig. 7). This anchoring was done for two purposes: first, because there is always danger of sloughing when intestines are inverted in this way, especially when the bowel has been distended and its walls thickened, while when sutured in this manner any leak would take place extraperitoneally; second I was of the opinion that the anastomosis would work better if the bowel was fixed to the abdominal wall. The wound was closed with a small piece of packing extending to the ends of the intestine.

Following the operation, there were no complications and the wound healed without any evidence of leakage from the closed ends of the intestine.

At this time, December, 1908 (two years and four months since the operation), the patient has had no further attacks of intestinal obstruction. He also informs me that his general health is better. There is no evidence of weakness in the scar, and the stools are normal in every respect (Fig. 8).

My second observation is of interest, because it allowed me to see a volvulus in its acute stage and, perhaps, the etiological factor.

CASE II.—Pathol. No. 7999; Mr. F. R. S.—*Diagnosis: acute intestinal obstruction two weeks after appendectomy. Operation seven hours after the onset of the symptoms. Laparotomy: reduction of volvulus of sigmoid, division of a band (Fig. 9) between the sigmoid colon and the peritoneum of the left iliac fossa. Recovery.*

Clinical History.—White male, aged 33. On February 19, 1907, at the St. Agnes Hospital, I removed the appendix through a McBurney-Weir incision and closed the wound without drainage.

Pathologic Findings at This Operation.—On opening the peritoneal cavity an unusually large cæcum and ascending colon were exposed; the mesentery of the cæcum was longer than normal and, covering the peritoneal surface of both extending to the mesentery, and in places to the parietal peritoneum at the base of the mesentery, there were numerous vascular bands of adhesions.

The appendix, 8 cm. long and free, was situated to the lower and median side of the cæcum. The appendix was covered with a fine net-work of new blood-vessels which extended to the cæcum. There was one band of adhesions producing an S-like constriction in the middle third of the appendix. These findings I have observed before in cases of enteroptosis of the colon. The adhesion producing a constriction of the appendix without doubt interfered with the emptying of this organ. The removed appendix showed an unusually large lumen and a wall thicker than normal. The right kidney was of normal size and in place.

Clinical History.—The patient was referred to me with symptoms of renal colic. The first attack had taken place one year before. The attacks consisted of pain in the lumbar region and the right groin. These attacks were observed only when the patient was standing. The pain was of a dull character and was not associated with nausea or vomiting. The attacks have never been severe enough to confine the patient to bed. After the attacks the urine was cloudy, but there was no blood. The X-ray examination was negative as to renal calculi in kidney and ureter. On examination the kidneys could not be palpated, but on two occasions I felt in the right iliac fossa a movable finger-like mass. The urine contained a trace of albumin, oxalate crystals, and a few red blood-cells.

Postoperative Notes.—The acute attack began two weeks after the appendectomy and after the patient had been out of bed about three days. He had been constipated twenty-four hours, but went to bed feeling first rate. At about three o'clock in the morning the patient was awakened out of a sound sleep with pain referred to the left loin posteriorly. The description of the pain answered somewhat to that of a renal colic. The pain in the first few hours was so intense that there were slight symptoms of shock (the so-called peritoneal shock,—an early sign of strangulation. There was the initial vomiting of acute obstruction. When the resident, Dr. Shaw, examined him one hour after the onset of the pain, the patient was rolling in bed from side to side, flexing the thighs on the abdomen. The face was pale, the pulse, recorded at 8 P.M., at that time about 80, was now 120, the temperature (by mouth) subnormal. Morphia, gr. $\frac{1}{8}$, was given at once and repeated in three-quarters of an hour. This simply relieved the acuteness of the pain. Two enemata were ineffec-

tual. When the stomach was washed out nothing was removed but a little bile-stained fluid.

I saw the patient six hours after the first symptom. The pain now was of a dull character. The symptoms of peritoneal shock had disappeared. The pulse was 90, the temperature 99. The total leucocytosis was 36,000, on a second count 40,000. The urine contained red blood-cells, a trace of albumin and some casts. This finding, which had been present before the first operation, had disappeared a few days later. When the foot of the bed was lowered for my examination (the patient had been placed in this position on account of shock) he complained of nausea and vomited; the pulse increased to 130. There was no recurrence of the vomiting and the pulse dropped to 90. The area of pain was in the left loin to the outer side of a vertical line through the anterior iliac spine. This area, in my experience, was situated lower and more to the median side than the pain in renal colic. On palpation, the patient stated that there was no tenderness, but the left rectus and the left abdominal muscles were rigid, preventing deep palpation. I could make out no mass. On percussion, there was very slight obliteration of the liver dullness, although the abdomen was not distended, and in the left lumbar region there was a distinct zone of flatness not present on the right side. On further palpation, as the muscles relaxed, I was of the opinion that I could feel a tense, smooth tumor in the iliac fossa (Von Wahl's sign). The symptoms,—shock, initial vomiting, Von Wahl's sign, the inability to get fæces or gas with enemata—were, in my opinion, evidence against renal colic and in favor of obstruction. In addition, we had a previous X-ray as further evidence against stone. The attack of pain on this left side differed from those on the right in intensity. It seemed to me quite possible that the adhesions observed on the right side might also be present on the left side in the mesentery of the sigmoid colon.

For these reasons I considered the diagnosis of volvulus as most probable and advised immediate operation rather than delay for attempts with further enemata. On opening the peritoneum through the left rectus muscle there was no fluid, and normal, non-distended small intestines were exposed. Pushing these intestines upwards and to the median side I could see a very greatly distended sigmoid colon. It was not twisted. The veins

in the mesentery of this colon were tremendously engorged—an appearance in distinct contrast to the vessels in the mesentery of the small intestine, descending and transverse colon. This engorgement of the veins impressed me as the result of a twist in the sigmoid which had relieved itself, or which I had relieved in the manipulation necessary to expose it. The splenic and descending colon were distended. As I pulled the sigmoid colon out of the abdominal wound I observed an acute flexion in the upper third. From the mesentery at the apex of this flexion a definite band of adhesions passed down along the mesosigmoid to the peritoneum of the left iliac fossa (see Fig. 9). The foot points of the “U” of the sigmoid were close together. The entire sigmoid was distended, and this distention extended into the rectum as far as it could be inspected. Now a rectal tube was passed, and a large quantity of gas and fecal matter withdrawn. I was able to increase this quantity by compression of the colon and rectum, and then hard fecal masses which were not evacuated by the tube could be felt.

As a rectal tube had been passed a few hours before operation with a negative result, it seems justifiable to conclude that the obstruction was relieved during the operation, because the rectum below the sigmoid was distended with gas and liquid fecal matter.

A complete resection of the sigmoid colon with lateral anastomosis of its foot points would not have been a difficult operation, but I decided to confine my intervention to division of the band only. After this band was divided the raw surface was covered with peritoneal suture.

Twelve hours after operation there was a large liquid stool containing solid fecal masses.

The convalescence from this operation was uneventful. One month after operation the patient had a slight attack of pain in the right hypochondrium. Three months later a second attack with nausea and vomiting. This attack was associated with constipation. At the present writing, December, 1908, one year and eight months since the second operation, there have been no further attacks.

CASE III.—Pathol. No. 7942. *Clinical Diagnosis: Question between volvulus and carcinoma of the sigmoid. Patient observed five days after the onset of the acute attack of intestinal obstruction. Exploratory laparotomy; negative findings.*

Clinical History.—E. R. L., white, male, aged 40, was admitted to the Johns Hopkins Hospital on August 22, 1906, and the following history was obtained from Dr. Carr, his physician, and the patient. In the previous history there is nothing suggestive except that four and two years ago there were distinct attacks of dysentery in which the stools contained blood and mucus. In the interval between these attacks there were no symptoms, but the last year the patient has observed an increasing constipation with intermittent ribbon stools, but no loss of weight and no evidence of weakness or anæmia.

The acute attack began five days before his admission to the hospital. The symptom of onset was pain beginning in the left lumbar area and extending from here into the left iliac fossa, the groin, and the left testicle. The pain began about ten in the evening, some hours after the last meal. Previous to the onset of the pain there had been no unusual constipation that the patient could remember. The pain began acutely, the patient feeling in perfect health before. The first attack of pain lasted four hours, and there was vomiting. Between Thursday and Sunday evening—a period of three days—there were four such attacks of pain. Except in the first attack the pain was not referred to the testicle. With each attack there was vomiting. As far as I could make out there was no marked shock. During this time he was given castor oil and numerous enemata without effect. When seen Sunday evening by Dr. Carr there was an indistinct tender mass in the left iliac fossa. After this examination there was a large stool following the administration of a high enema. Since this time there have been no further symptoms, and the mass and tenderness have practically disappeared. He entered the hospital Tuesday morning, about 36 hours after the end of the symptoms. The patient was not in discomfort, there was no abdominal distention, but on deep palpation in the iliac fossa one gets the impression of feeling a distended piece of bowel. The urine was negative, the leucocyte count 7,000. When I first saw the patient, although he was feeling comfortable, the bowels had moved and he did not feel nauseated, there was a distinct fecal odor to the breath, and one suggesting acetone, and during my examination the patient expectorated a thin brownish fluid which had a distinct fecal odor. For this reason I am inclined to the opinion that there had been fecal vomiting. This odor disappeared within 24 hours.

At this date, in 1906, over two years ago I was quite familiar with the clinical picture of volvulus from a study of the case reported first in this paper, because this patient (Case III) entered the hospital about three weeks after I had operated upon the patient in Case I. From this clinical history, however, one could not exclude a malignant tumor of the large bowel.

In a study of a number of such cases I have been struck with the observation that in the previous history, acute attacks of intestinal obstruction, lasting from one to five days with recovery after enemata have been present in at least one-fourth of the cases. *It is so unusual for a patient with acute intestinal obstruction to recover without operation, that such a history can be looked upon as evidence of a malignant tumor, but this more recent study of the rarer lesion—volvulus of the sigmoid colon—demonstrates that the same may occur here.*

At the operation in this third case on August 28, 1906, six days after the patient had been in the hospital without symptoms, I could find nothing abnormal. I could positively exclude a new growth. Whether there had been a volvulus I am not prepared to say. I carefully examined the mesentery of the sigmoid colon and could not find the adhesions observed in Case II and in Cases IV and V to be considered next. Whether at that time I overlooked some anatomical changes which I might recognize to-day from a larger experience, I am not prepared to say, but the gross lesions found in the other cases were not present. I am inclined, however, to the opinion that this patient had suffered from a volvulus of the sigmoid colon, and perhaps during the two attacks of dysentery inflammatory changes in the mesocolon had led to certain changes which were the etiological factor of the volvulus. This was distinctly so in the fourth case about to be reported.

At the present writing, December, 1908, two years and three months since the operation, this patient writes me that he is in perfect health and has had no further attacks.

CASE IV.—Pathol. No. 9149. *Clinical Diagnosis: Chronic obstruction of the sigmoid colon. Operation: Freeing of adhesions between the parietal peritoneum of the iliac muscle and the mesocolon (Fig. 10). Recovery.*

This patient, a white male, aged 30, was brought to me by Dr. Gregg, of Florence, S.C., with a clinical history very suggestive of a stone in the left kidney. However, in going over the

FIG. 10.



CASE IV.—Sketch of the findings at operation showing the dense adhesions between the junction of the sigmoid and descending colon and the parietal peritoneum of the iliac fossa. The appendix is retracted into a "U"-shaped organ by a shortened mesentery.

FIG. 11.



CASE V.—Sketch of findings at operation, showing the adhesions between the sigmoid colon and the parietal peritoneum at the brim of the pelvis and the broad ligament.

facts in the history I came to the conclusion that I was dealing with a chronic obstruction in the sigmoid colon. It was my experience with the cases just reported that led me to this belief. The X-ray showed no stone in kidney or ureter.

We have in this case a history of dysentery ten years ago, lasting some months. The first attack of abdominal pain began four years after the dysentery. In these six years there was an interval of five years between the first and second attack of pain, and in the last four months there have been five attacks. The pain is referred to the same area described in Cases I and II. It is always preceded by constipation and associated with nausea and vomiting. The intense pain lasts from two to six hours. The relief is immediate when the enema is successful; sometimes more than one enema is required. In none of these attacks has the pain been referred to the testicle. Three months ago he had a slight attack of pain in the right iliac fossa.

The *operation* was performed at St. Agnes Hospital in August, 1908. The sigmoid was explored through an incision at the outer border of the left rectus muscle with the patient in the Trendelenburg position. The findings were practically identical with those in Case II. The band of adhesions on the whole was broader and shorter (see Fig. 10). Influenced by the involvement of the appendix in Case II, I explored the appendix in this case through a McBurney incision, and removed it. The appendix was free and apparently normal, but hitched up by a shortened mesentery (Fig. 10).

It is four months since the operation, and the patient has had no recurrence, although in the three months preceding the operation there had been three attacks.

CASE V.—Pathol. No. 9319. (*Recent case*). *Clinical Diagnosis: Chronic obstruction of the sigmoid colon of many years' duration. Operation: Freeing of adhesions (Fig. 11). Recovery.*

Clinical History.—White female, aged 38, married, no children. It was very difficult to get a clear clinical history. When I first saw the patient two years before the operation she had every symptom of a grave melancholia. However, from the history at that time, I was of the opinion that there was some mechanical obstruction in the sigmoid colon, and operation was advised. I did not see the patient again until October, 1908. During these two years, in spite of absolute rest and the most careful dietetic treatment, the symptoms had increased.

The patient had become a chronic invalid. She was in such a nervous state that she would not allow an examination of the abdomen. The slightest touch of the abdomen, the patient claimed, made her so nervous that she could not control herself, and it produced nausea.

Evidently some fifteen years ago, shortly after marriage, there had been a pelvic peritonitis, perhaps of gonorrhœal origin. Gradually after this illness she observed increasing constipation, and during the last six years, in order to move the bowels, it has been necessary to take larger doses of cathartics. The patient has administered to herself a proprietary "liver pill," and the doses gradually increased from two to sixteen and twenty a day. Formed stools have not been observed for five years, and during the last two years it was necessary that they should be liquid before an evacuation could be had. The patient states that during all this time she experienced pain in the left lower abdominal quadrant. The pain is worse when twenty-four hours intervene without a stool. If she allows the constipation to go longer she observes distention in the left side of the abdomen, increase of the pain, and now and then vomiting. For three years she has been unable to continue her profession as a dentist and has sought relief in rest and diet. Except for this definite history of constipation and localized pain and the absence of normal formed stools, the patient exhibits the exaggerated picture of a neurosis.

I felt, however, from my experience in the other cases that there was a mechanical non-malignant obstruction. Its long duration excluded a malignant tumor; the old pelvic peritonitis suggested the etiological factor.

The operation was performed at the St. Agnes Hospital November 7, 1908. The sigmoid was plastered by dense fibrous adhesions to the parietal peritoneum over the iliac muscle at the brim of the pelvis to the broad ligament, tube and ovary on the left side. The sigmoid could not be lifted from this bed. It was less movable than the lower half of the duodenum, and in this position there were two or three kinks (Fig. 11). The adhesions could be divided with the knife in such a way that the visceral peritoneum of the sigmoid was not injured. After accomplishing this I could lift the sigmoid and demonstrate that its mesentery, although somewhat involved in the adhesions, was still intact. That is, the mesentery had not yet been converted into scar tissue.

Both tubes and the left ovary were removed. There were adhesions between the uterus and the rectum which could be divided with the knife and scissors. The division of all these adhesions caused practically no bleeding. The raw surfaces could be covered with peritoneal suture.

This patient, after operation, suffered for five days with distention of the abdomen. That is, the postoperative paresis of the intestines was much more marked than usual. After this had subsided and the patient began to take ordinary diet, normal formed stools were observed for the first time in years, and I was able to gradually reduce the cathartic pills to two a day.

This patient is still in the hospital, one month after operation, because of a phlebitis of the right leg on the fifteenth day and a left-sided pleurisy on the twenty-third day. These complications, we know, are more frequent after pelvic operations.

Remarks.—Volvulus of the sigmoid colon is one of the rarer forms of intestinal obstruction. Among 103 cases of intestinal obstruction observed in Dr. Halsted's clinic of the Johns Hopkins Hospital there have been but two examples observed. The first case is reported here; the second observation is an example of a recovery, although the operation of untwisting was not performed until the sixth day after the onset, and it is interesting to note that in this case there was a recurrent attack within a year after the patient left the hospital which terminated fatally without operative intervention.

Literature.—I have examined the literature since 1902, and it seems to be the opinion of the majority that the volvulus recurs if at the operation for relief the surgeon contents himself with only untwisting. No one, however, has advocated resection as a primary operation in all cases. If gangrene is present resection, of course, is indicated.

Kiwull, a Russian surgeon, in 1902 (*Mittheilungen a. d. Grenzgebieten d. Med. u. Chir.*, 1902, vol. x, p. 105) gives a very good discussion of the diagnosis. He recognizes two types,—first, the acute volvulus in which the clinical history and symptoms are practically identical with my Case II, the

initial vomiting and shock of which, so common in the so-called group of strangulated ileus, are here present; second, the subacute type, in which these symptoms are absent and the vomiting does not come on until later. In all cases there is usually a previous history of constipation, in some the acute attack follows a large meal, in others a trauma. In all of the cases absolute constipation of fæces and gas is observed, and if the examination is made early there is an asymmetrical distention on the left side of the abdomen. In a few cases the palpation of the distended loop (Von Wahl's sign) has been made out. This sign is more readily obtained if the abdominal muscles are relaxed by placing the patient in a warm bath. Peristalsis, if present, is observed chiefly in the transverse and descending colon: rarely in the distended sigmoid loop (Chart 1). Pain referred to the lumbar region,—a constant symptom in my cases,—is not mentioned prominently in the literature.

Kiwull reports eight cases observed in his clinic. This number is not only unusually large, but the results of operation were unusually good. There was but one death from pneumonia in a patient aged seventy-one. All of the patients were over forty years of age, and but one was a female. In the majority of his cases the operation was performed within forty-eight hours. It consisted in untwisting of the volvulus. In this report there are no observations of the condition of the mesentery. Gangrene was not observed, but in one case the circulation of the sigmoid looked impaired and for this reason the replaced intestine was isolated with iodoformized gauze. In the healing there was evidence of a fecal fistula which closed spontaneously. Kiwull expresses the opinion that the distended sigmoid is better evacuated of gas and fæces by the introduction of a rectal tube at the operation, rather than by colostomy. This view stands good to-day. Kiwull states that the seven patients which recovered from the operation have been examined repeatedly since and there have been no recurrent attacks. Nevertheless when we read the detailed histories in not a single instance do we find a note of a later

examination. For this reason I feel that Kiwull's statement as to results cannot be accepted.

Kuhn contributes a monograph (*Beitr. z. klin. Chir.*, 1902, vol. xxxvi, p. 411), from Garrè's clinic, in which he reports 9 cases from his clinic and 95 from the literature. Among these 104 cases, in 20, resection was performed with about 50 per cent. of recoveries.

I have examined these cases of resection critically, and I am of the opinion that resection in acute volvulus is only indicated when gangrene is present. It is a simple procedure to untwist the volvulus and to evacuate the distended bowel by the passage of a rectal tube. In gangrene the loop must be brought out of the abdominal cavity. Now the question arises, what further should be done? I am of the opinion that a lateral anastomosis should be made between the descending colon and the rectum, the gangrenous sigmoid rapidly resected, and the two open ends of the gut sutured in the parietal peritoneum for secondary closure. Kuhn reports one successful resection for gangrene, by Garrè.

Kuhn, from his study, is of the opinion that relief by the rectal tube and enemata will usually fail and that immediate operation is indicated, and that in the majority of cases, if resection is not indicated in the primary operation because of gangrene, it should be done at a secondary operation.

Philipowicz (*Arch. f. klin. Chir.*, 1906, vol. lxx, pp. 678 and 897) has had an unusual experience with volvulus of the sigmoid. In the first place his material is very large. Thirty-two among ninety-eight cases of intestinal obstruction observed in his clinic in Czernowitz, involved the sigmoid flexure. In the second place his mortality is unusually high. Of twelve patients not subjected to operation eight died,—a mortality of 66 per cent. Of twenty patients operated upon, thirteen died,—65 per cent. This unusually large number of cases not subjected to operation and the high mortality of the operative intervention seems to be explained by Philipowicz's faith in the rectal tube which he attempts first in every case and he advises that operation should not be done before the third day.

Scudder of Boston (Reprint 1908, reference not given) reports on 121 cases of acute obstruction from the Massachusetts General Hospital. Among these there are nine cases of volvulus with nine deaths. Among these but two involved the sigmoid flexure. Resection was performed in one, colostomy in the other.

Conclusions.—This study of volvulus of the sigmoid must be looked upon as incomplete. My own experience is limited, and the cases reported in the literature are not given with sufficient detail to draw definite conclusions as to the etiological factors.

At the present time, I am of the opinion, that the symptoms of acute or subacute volvulus of the sigmoid are sufficiently evident to allow treatment to be instituted in a stage in which the prognosis should be uniformly good. In the first place, the attempts at relief with the rectal tube and enemata should not be continued more than a few hours. During this time the patient should have no food and no cathartics. If this is unsuccessful the abdomen should be opened at once. When this is done resection is only indicated in the presence of gangrene. After untwisting the volvulus the bowel should be evacuated with the rectal tube. Now one should search in the region of the mesentery for bands or adhesions; these should be relieved and the raw surfaces covered with peritoneal suture. These patients should be carefully instructed, after their recovery, as to their diet and the use of cathartics to prevent constipation. In the event of recurrent attacks resection, as in my Case I, is indicated.

As to the other cases which I have reported in which the symptoms are chronic, laparotomy is indicated not only to relieve these symptoms, but as a prophylactic measure against the development of acute volvulus.