

her one hundred $\frac{1}{2}$ -grain morphine tablets with $\frac{1}{200}$ grain atropine, and when she promptly swallowed ten she came under observation suffering from severe atropine poisoning.

This patient made a recovery from the poisoning, and under treatment for the morphinism has gone back to the pipe. This means one step in the cure of many patients, although it is true that most go the other way. In fact, among smokers it is often regarded that when one goes from the pipe to the "gun" they are going down hill.

VOLVULUS OF THE SMALL INTESTINE—ITS RELATIONS TO HERNIA. TORSION OF THE ENTIRE MESENTERY. REPORT AND RÉSUMÉ OF CASES.¹

BY GEORGE TULLY VAUGHAN, M.D.,

OF WASHINGTON, D. C.,

ASSISTANT SURGEON-GENERAL U. S. PUBLIC HEALTH AND MARINE HOSPITAL SERVICE; PROFESSOR
OF SURGERY, GEORGETOWN UNIVERSITY, AND IN THE WASHINGTON POST-GRADUATE SCHOOL
OF MEDICINE; BRIGADE SURGEON U. S. VOLUNTEERS DURING THE WAR WITH
SPAIN; FELLOW OF AMERICAN SURGICAL ASSOCIATION.

SOME years ago Leichtenstern found in about 1500 cases of intestinal obstruction that only 33, or a little over 2 per cent., were caused by volvulus.

In Gibson's recent article—"A Study of 1000 Operations for Acute Intestinal Obstruction and Gangrenous Hernia"—volvulus is given as the cause of obstruction in 12 per cent. of the cases, becoming fourth in the list of causes, hernia holding the first place, with 35 per cent., and intussusception and bands becoming second and third, each occurring in about 19 per cent. of cases; so volvulus is now recognized far more frequently than formerly as a cause of intestinal obstruction.

DEFINITION. Volvulus is from the Latin word *volvere*, to roll. In surgery it means the rolling or turning of the intestine and mesentery in such a manner as to obstruct the lumen of the intestine, the circulation in the bloodvessels, or both.

For a long time volvulus was used synonymously with ileus, and meant almost any form of intestinal obstruction. In a thesis written in 1765, Grol states that volvulus is caused by erysipelas, inflammation, tumors, scirrhus, fecal impaction, enteroliths, worms, and intussusception.

Early in the last century Rokitansky described three forms of volvulus:

1. Rotation of the bowel on its own axis.
2. Rotation of a loop of bowel around its mesenteric axis.
3. The intertwining of two adjacent loops of bowel.

¹ Read by title at the meeting of the Association of Military Surgeons, at Washington, D. C., June 7, 1902.

ANATOMY, ETIOLOGY, AND PATHOLOGY. The mesentery is a fan-shaped double fold of peritoneum extending from the vertebral column to the convolutions of the jejunum and ileum, which it envelops, forming their peritoneal coat. The root of the mesentery is about six inches broad, extending obliquely from the left side of the second lumbar vertebra to the right sacro-iliac symphysis. Its length is about four inches from the vertebral attachment to the intestines, where it spreads out like a fan to include some nineteen feet of intestine. It contains between its folds the vessels and nerves of the small intestine. The shape of the mesentery, with its narrow pedicle or root and its broad periphery, would seem to make it an easy victim of rotation whenever the vermicular motion of the intestines attached to its broad end becomes unusually active, and the only surprise is that torsion of the mesentery is not more frequent. A *portion* of the mesentery may be involved, as in case of rotation of a coil of intestine, say fifteen inches long, the portion attached to that coil would undergo torsion; or the *entire* mesentery attached to nineteen feet of intestine may be twisted by rotation around its own axis, either from right to left or from left to right, making from half a turn (180 degrees) to two complete turns, as in a case reported by Delore, in which almost the entire ileum was twisted twice around its mesentery from right to left. Bassinot believes that the direction of rotation is more frequently from right to left, as the hands of a watch move; and this opinion seems plausible when we consider the oblique attachment of the root of the mesentery, the upper border bearing to the left and the lower border to the right, so that a weight or traction acting vertically on the upper border in line with the long axis of the body when erect would tend to pull it down on the left side while the lower border ascends. This motion continued would cause rotation from right to left, or as the hands of a clock move. But my statistics, while not numerous enough to be of much value, do not sustain this theory, as in 14 cases of torsion of the entire mesentery in which the direction was given, only 6 were from right to left and 8 were in the reverse direction. Taking all the cases together of torsion of the *entire* mesentery and of *parts* of the mesentery in which the direction of the turn is given, we have 24 cases, in 11 of which the direction is from right to left and in 13 the reverse.

Rotation of a segment of intestine on its longitudinal axis is rare, but it may be caused by bands, adhesions, or tumors. A tumor attached to the upper border of a horizontal portion of intestine would by gravity tend to fall below, bringing the upper border with it, rotating the tube on its axis, and possibly diminishing its lumen and obstructing its vessels. It is more common for a tumor to produce rotation of the mesentery, as in Case 4, Series II., reported by Briddon.

Volvulus may produce obstruction of the circulation or of the lumen

of the intestine; usually it does both. Torsion of the mesentery on its axis not only arrests the venous return from the intestines—which in turn reacts on the capillary and arterial circulation, causing, if complete, rapid death of nearly the entire small bowel, often preceded by hemorrhage both into the lumen of the bowel and into the peritoneal cavity; but usually by pressure of one or both of its tightly stretched borders it obstructs the lumen of the gut, and while this *may* block both ends of the tube it almost invariably affects the lower end, usually the ileum. Sometimes the pressure is so great as to cause ulceration at the point of pressure, or division of the coats of the bowel, as was stated by Captain Smyth in Case 7, Series II.

The lumen of the intestine may be occluded by pressure of one segment of bowel on another without materially affecting the mesentery. Probably many cases of "colic" are caused by the latter form of volvulus, and as the intestine rights itself the symptoms disappear.

All authorities agree that volvulus occurs much more frequently in the colon than in the small intestine. Of 121 cases cited by Gibson 73 were in the colon, 58 in the sigmoid flexure, and 15 in other parts of the colon; and only 36, less than one-third, were found in the small intestine. Leichtenstern found in 76 cases of volvulus, 45 in the sigmoid flexure, 23 in the ileum, and 8 in the jejunum and ileum combined. In my collection no cases of volvulus of the large intestine are included.

The causes commonly given are, first, *age*. The average age of Gibson's 121 cases—both large and small intestine—was forty-five years. In my list of 54 cases—small intestine only—the average age was forty-one years, and the greatest in any decade was 11, between fifty and sixty years. If we compare the average age of the cases in which hernia was associated with volvulus with those in which there was no hernia we are at once struck with the difference, in the former the average age being fifty-four years and in the latter thirty-six years. Volvulus may occur at any age—several have been reported in persons over seventy years; and Tissier and Mercier report a congenital case.

Second, *sex*. It seems to be somewhat more frequent in males. Gibson gives 67 males to 40 females, while the proportion in my list is 32 males to 27 females.

Third, *abnormally long mesentery*. A long mesentery, like the elongated pedicle of a tumor, predisposes to rotation. The mesentery may be congenitally long, or its length may be increased by traction on the bowels by means of fecal accumulations which especially affect the sigmoid flexure, adhesions, tumors, hernia, or general loss of flesh. There is no doubt that volvulus of the mesentery proper may and does occur without elongation. With the mesentery elongated like a

pedicle, a slight force may cause the intestines to revolve and twist the mesentery on its axis. This force may be violent exercise, unusual peristaltic action as a result of indigestion, or traumatism, as in cases reported by Turner, Hawkins, Staveley, and Giddings.

Hernia is not infrequently associated with and is the cause of volvulus. Volvulus may affect the intestine and the small portion of mesentery in a hernia sac, or it may be wholly within the abdominal cavity and involve the entire mesentery, while only a short coil of intestine is found in an external hernia. Volvulus may be caused by traction of a coil of intestine attached to the highest part of the mesentery dragging it down so that it becomes the lowest part, and thus makes a half revolution (180 degrees) on its axis. Such seems to have been the condition in the following case:

CASE 21. *Volvulus with hernia; death in less than twenty-four hours.*—H. W., negro, aged thirty-five years; was taken sick January 21, 1902, at night, with pain, cramps in the bowels, and vomiting. He had had a right inguinal hernia several years, and this had come down, and he thought the trouble was caused by it, as he could not reduce it. Next morning he went to work as a laborer, but felt so weak on account of the pain in the bowels and vomiting that he had to stop, and was brought to the Emergency Hospital about 12 o'clock, January 22d. A hernia in the right side of the scrotum was reduced by taxis without difficulty, and he experienced some relief; but soon after it was noticed that his pulse had not improved—it was 100 and very weak and thready, scarcely perceptible at the wrist—and he continued to vomit. When I saw him at 4 P.M., about twenty hours after he was taken sick, he was in collapse; pulse as given; temperature subnormal (97.4° F.); voice so weak that it could scarcely be heard; little pain, but that was in the bowels. He began to vomit while I was looking at him, and vomited over 1000 c.c. of chylous-looking fluid, and immediately died.

Post-mortem Examination. On opening the abdomen over 1000 c.c. of dark, bloody fluid were found in the peritoneal cavity. The intestines which presented were black and leathery and offensive. The bulk of the gangrenous intestines lay on the left side. Examination showed a twist of the mesentery from right to left through an arc of 180 degrees, including the superior mesenteric artery and vein. The vein contained large thrombi, and the edge of the mesentery compressed a point in the small intestine about eight feet from the pylorus, enough to leave an indentation. The cæcum with appendix were drawn tightly on the stretch toward the left side, and both were gangrenous. The small intestine from the point indented by the edge of the mesentery to a point just above the cæcum, a little over thirteen feet, was gangrenous, black, and leathery. No perforation was found. The rest of the intestine above and below was in good condition, only considerably congested. The intestine contained a quantity of bloody fluid similar to that in the peritoneal cavity. It is possible that the hernia, which was a coil of the upper ileum or jejunum, started the mesentery to rotating by traction.

Sometimes the volvulus in the abdomen is kept in twist by the fixation of the coil in the hernial sac. Such was the explanation of several cases, especially those reported by Knaggs.

SYMPTOMS AND DIAGNOSIS. The symptoms of volvulus of the small intestine are those of acute intestinal obstruction, coming on suddenly, often when the patient is seemingly in perfect health. Pain of a severe, colicky character, usually in the abdomen, although in one case it was most severe in the back (see Case 7); vomiting; rapid, feeble pulse; subnormal temperature; obstinate constipation, purgatives having no effect; distention of the abdomen, and great prostration. Vomiting is usually present, but in the histories given it was reported absent in five cases—8 per cent. Many times the vomitus becomes stercoraceous, proving that although the intestine may be obstructed below it may yet remain pervious above. The pulse may be little changed for the first six or eight hours; after that it becomes feeble, thready, and 100 to 160 a minute. The temperature is unreliable; it may be normal for a while, then somewhat elevated—100° to 101° F.; but later it is often subnormal. The abdomen is usually distended and tympanitic. In the early stages, before tympanites becomes general, a circumscribed area of tympanites in the hypogastric region, due to distention with gas of the portion of intestine involved, is a valuable symptom. There is usually tenderness over certain parts of the abdomen, and sometimes a swelling, band, or ridge can be made out by palpation. Occasionally a definite mass or tumor can be felt within the abdomen.

Rectal or vaginal examination will sometimes disclose a boggy mass in the rectovesical or rectovaginal pouch. This point has been emphasized by Major Williams, of the Indian Medical Service (Case 20), and mentioned by Homans, Littlewood, and others. While a bloody effusion often occurs both in the peritoneal cavity and in the intestine affected, blood is seldom vomited or passed at stool.

The diagnosis may be difficult as to volvulus, but it is easy to determine the existence of intestinal obstruction, and that is enough to indicate the proper line of treatment.

The most unfortunate mistakes are liable to be made when an unseen volvulus is associated with a visible hernia. A patient with hernia may have symptoms of obstruction or strangulation. The hernial sac is opened and a congested coil of intestine is reduced; but if a volvulus exists in the abdomen, as it too often does, the symptoms are not removed, and death relieves the patient unless the surgeon does by another operation. My case is a good example of this, in which the patient's life was saved by a stroke of good luck.

CASE 39. *Inguinal hernia with volvulus in the abdomen; resection of intestine; recovery.*—W. G., aged sixty years; male negro; had had a right inguinal hernia for many years, and was operated on for strangu-

lation ten years ago. January 8, 1900, at 10.30 A.M., while lifting a cake of ice, the hernia came down in spite of his truss, and he was unable to reduce it. He had severe pain in the abdomen and vomiting. Patient was operated on at the Emergency Hospital at 3 P.M., four and a half hours after the symptoms began, under chloroform. The tumor was about the size of an adult head, and very tense and dull on percussion over the lower part. The sac, which was anatomically congenital, was opened and found to contain the cæcum, part of the ileum, and a large mass of omentum, which was adherent to the bottom of the sac. The small intestine was slightly congested and was reduced, when, to my surprise, a coil of small intestine, black and gangrenous, came into view. It was up to this moment in the abdominal cavity and not in the hernial sac. The coil was pulled down until a sound part was reached, and twenty-eight inches were resected and the ends united with a Murphy button. The mesentery was swollen and cedematous. The omentum was ligated, cut away from the sac, and returned to the abdominal cavity, and Bassini's operation for the radical cure of hernia was performed, the wound being closed without drainage. The patient recovered without incident, passing the Murphy button on the fourteenth day, and was discharged on the eighteenth day after the operation. When seen more than a year later, he was perfectly well.

PROGNOSIS. In my list of 61 cases there were 51 operations, with 21 recoveries—a mortality of 60 per cent. Separating the two classes, we find 17 operations for twisting of the entire mesentery, with only 4 recoveries—a mortality of 76 per cent. Delbet's second case, which died of pneumonia eleven days after the operation, is included in the fatal cases, although in a sense it may be regarded as a success, as the patient died from another cause than the operation. There were 34 operations for volvulus of *part* of the mesentery, with 17 recoveries—a mortality of 50 per cent. Gibson reports 36 cases of volvulus of the *small* intestine operated on, with 25 deaths—a mortality of 70 per cent.; and of the colon, 73 cases, with 34 deaths—a mortality of 50 per cent. The high mortality in the operations for volvulus *entire* is due to three causes: First, *the more serious nature* of a condition which strangulates almost the entire small intestine, injures the sympathetic plexus, and perhaps produces a rapidly fatal toxæmia—less than twenty-four hours in my case; second, *delay in operating*: of the 14 cases in which the time was given which elapsed between the onset of the symptoms and the operation it ranged from ten hours to nine days, all the successful cases being operated on in less than forty-eight hours, except Major Brown's case, in which the symptoms were at first not acute; and, third, *the difficulty of recognizing the true condition*, in order to act intelligently—four operators candidly confessed their inability to do so after opening the abdomen, and the patients died without relief, the true condition being at last disclosed by a necropsy.

TREATMENT. G. H. Hunter advises the treatment of volvulus by rotation of the body of the patient around its long axis in the opposite direction to the volvulus, ascertaining this by the lack of pain when the patient turns in the proper direction. With the symptoms of acute obstruction usually seen in volvulus there should be no hesitation in performing laparotomy at the earliest possible moment. The abdomen should be opened near the median line, as a rule, through the right rectus muscle, in order to be more convenient to the root of the mesentery for the purpose of making an examination, unless there is a tumor perceptible, when it is best to make the incision over the tumor.

The escape of bloody fluid on opening the peritoneum is often seen. The intestines are usually distended, congested, and often brown or black in color. Examination of the coats of the intestines and the mesentery shows enlarged, swollen veins. Search should be made for other causes of obstruction—such as hernia, tumors, intussusception, bands—and then the mesentery should be examined thoroughly, removing, if necessary, all the coils of the small intestine from the abdomen in order to do so. The difficulty in finding the trouble can be better appreciated by reading the experience of Major Debrie and of Kirmisson, Delbet, and Delore. Kirmisson frankly confesses that he took the twist of the mesentery for the ligament of Treitz, and did not recognize the true condition. Delbet failed to recognize the condition in his first case, and was under the impression that it might be a retroperitoneal hernia, as two segments of intestine—one collapsed, the other distended—passed behind a tense fold of peritoneum. He made an anastomosis between these two parts of the bowel, and found at the necropsy that he had united the first part of the jejunum with the last coil of the ileum.

If the intestine is gangrenous it should be removed and an end-to-end anastomosis made unless the extent exceed ten feet; excision of a greater length, as shown by experiment and experience, is almost inevitably fatal. Gibson stated in 1900 that there was only one record of successful resection of the small intestine for volvulus—that of 127 centimetres (4½ feet) by Riedel. In my list of 51 operations there were 3 resections, with recovery. In one of them—Dreesman's case—2.15 metres (7 feet) were removed.

In operating on hernia with symptoms of obstruction the surgeon should always bear in mind the possibility of the existence of volvulus in the abdomen. The condition and relation of the contents of the hernial sac—as a swollen and congested loop of bowel, with insufficient constriction at the rings to account for it, or an intestine of unusual appearance which could not explain the symptoms of obstruction—should excite suspicion of this complication. In every case the sur-

geon should satisfy himself on this point by pulling down the coils of intestine, or, if necessary, by opening the abdomen.

The contents of every case of strangulated hernia should be carefully inspected—that is, under no circumstances should a *strangulated* hernia be reduced by the blind method of taxis unless there are good reasons for not operating.

Following is an abstract of 61 cases—by no means a complete list—taken from the literature. This list is divided into two classes: I. Those termed “entire”—21 in number—in which the *entire* mesentery is twisted, affecting almost the whole of the small intestine; and II., those termed “in part”—40 in number—in which only a *portion* of the mesentery is involved, and therefore only a small portion of the intestine is affected.

I. VOLVULUS OF THE ENTIRE MESENTERY.

CASE 1. *Volvulus of the entire mesentery; death.*—H. Rokitansky, in 1837, reported a case of hernia complicated with volvulus in a woman, aged seventy-one years. She was admitted to the hospital in December, 1830, with symptoms of strangulated hernia. The hernia was reduced by taxis, but the patient died ten days later.

Necropsy. There was peritonitis and the mesentery folded and completely twisted on itself, forming a kind of axis $4\frac{1}{2}$ inches long and $1\frac{1}{2}$ inches thick, around which the small intestines were rolled. The small intestine descended from the duodenum to the right iliac fossa and twisted upon itself in front of the vertebral column, making two circuits around the axis formed by the mesentery. The intestine was discolored, soft, friable, and perforated about two inches from the ileo-cæcal valve.

CASE 2 (Rokitansky). *Death.*—A woman, aged seventy-two years, in 1833, suffered with fever, nausea, pain, and tympanites of the stomach; fecal vomiting and death in three days.

Necropsy. Peritonitis. Very long mesentery, which was twisted one and a half times around its axis, the ileum occupying the upper part of the abdomen, while the jejunum occupied the left umbilical region. The species of cord formed by the mesentery (twisted) pressed the two extremities of the small intestine against the left side of the vertebral column—the ileum, which from one and a half feet from the cæcum extended downward and toward the right side, while the upper part of the jejunum passed under the mesentery in an opposite direction—upward and from right to left. Intestine deeply indented, as if cut by a ligature where pressed by the mesentery. Gangrene.

CASE 3 (Rokitansky). *Death.*—A woman, aged seventy-two years, died in 1839 after suffering from abdominal pain and fecal vomiting.

Necropsy. Stomach and intestine distended with gas and yellowish liquid. The mesentery was very much elongated, and twisted on itself in such a way that the ileum was situated in the upper and the jejunum in the lower part of the abdomen, the mass of intestines occupying the left and middle region of the abdomen.

CASE 4 (Rokitansky). *Death*.—A woman, aged seventy-one years, who had suffered twelve years with femoral hernia, died in 1839 from internal strangulation.

Necropsy. Distended abdomen; intestine containing gas and yellowish liquid; peritonitis. Mesentery attached to ileum was very long and folded and twisted on itself, forming an axis $4\frac{1}{2}$ inches long and $1\frac{1}{2}$ inches thick, around which the small intestine was wound.

CASE 5. *Operation; death*.—In September, 1885, Major Mignon, of the French army, saw a man, aged twenty-eight years, who had been taken suddenly ill with vomiting and severe pain in the abdomen. These symptoms continued during the night, and he was sent to the Val du Grace Hospital next day with the diagnosis of peritonitis. Twenty-four hours after the symptoms began the patient was hollow-eyed, with cold extremities; pulse 150, and feeble; temperature, 39° C.; abdomen distended only in the lower half; nausea and vomiting. Frequent desire to go to stool, but without effect. Laparotomy about thirty-six hours after the onset of the trouble, giving exit to 1500 c.c. of yellow fluid; the intestines were distended and purple. The mesentery of the small intestine was found twisted once on itself from left to right and from below upward, making a cord about one inch thick. This was untwisted, and the patient passed 200 grammes of liquid fecal matter, but died five hours after operation.

CASE 6. *Operation; recovery*.—Routier's case is as follows: A woman was taken suddenly ill in the night of January 8, 1890, with severe pain in the region of the transverse colon. Next day, the 9th, vomiting began and became fecal. There was no passage of stool or gas from the bowels. On the 10th fecal vomiting continued; temperature was 37.6° C.; pulse small, thready, and very rapid. The abdomen was large and somewhat tympanitic. To the left and on a level with the umbilicus was a painful region about the size of the palm of the hand; pain increased by pressure and percussion, and *something* other than muscular contraction was felt in this region. Internal strangulation was diagnosed and laparotomy performed on the evening of the 10th, about thirty-four hours after the attack began. The abdomen was opened below the navel and a quantity of turbid fluid escaped. The intestines were distended and congested, while other parts of the same intestine were collapsed and pale. Introducing the finger, all seemed free downward and to the right; but to the left a tense, hard body was felt, about 15 centimetres in diameter. Pulling on the distended intestine it was found to run down toward the right hypochondrium, and 80 centimetres were reeled off before resistance was felt. Exposing the part to sight, the intestine seemed to enter an opening like a hernial ring. Gentle traction on the intestine drew out about a metre, when the sense of resistance suddenly ceased, the ring disappeared, and the mass of intestines assumed their normal relations. The circulation seemed restored except that certain parts remained dark. The abdomen was closed, and the patient recovered after having a pneumonia.

CASE 7. *Operation; recovery*.—Major W. R. Brown, Indian Medical Service, operated December 21, 1892, on a coolie, aged fifty years, who had been taken with pain in the belly on December 16, soon after eating eight or nine plantains. The bowels moved slightly that day, but not at all during the next five days, in spite of purgatives. The pain continued, and the abdomen increased in size and became tym-

panitic; pain more on the right side. (Nothing was said about vomiting.) Pulse 76, but feeble. Laparotomy through the left rectus below the navel, afterward extended upward. The small intestines were distended and their bloodvessels much congested. No obstruction could be found, so the whole of the small intestine was taken from the abdomen and surrounded with warm cloths. The cæcum was then seen to lie to the *left* of the middle line, and on examining the mesentery it was found to be twisted on itself from *left* to *right*, and was much congested. The coils of small intestine were taken up in the four hands (operator's and assistant's) and rotated in the opposite direction. The cæcum returned to its normal position on the right, and immediately the noise of gas and fluid passing through the bowel was heard, and the bowels moved soon after. Wound closed with drainage tube left in. The patient made a good recovery and was discharged January 23, 1893, and was shown to a medical society February 24, 1893.

In the discussion Captain Smyth referred to the difficulty of recognizing the condition after the abdomen had been opened, and mentioned a case in which the abdomen had been closed without recognizing the trouble, the true condition being brought out at a necropsy. He had seen several cases on the post-mortem table. He stated that the actual seat of obstruction is to be found in the ileum, about six inches from the cæcum, where the gut is so compressed that the mucous membrane is sometimes divided, as in a case he had seen.

CASE 8. *Operation; death*.—Monod operated, April 2, 1893, on a girl, aged fifteen years, who was taken six days before with symptoms of intestinal obstruction. First, obstinate constipation (constipation was habitual), resisting the effects of purgatives; then distention of the abdomen, tympanites being greater in the centre than the periphery, as if the small intestine was distended, while the large intestine was not. There was no vomiting; the pulse was a little rapid, but good; temperature, 38° C. The patient complained most of severe pains in the region of the kidneys. On opening the abdomen the intestines presented as an enormous rounded mass, stretched almost to bursting, of a black-greenish color, resembling a cyst. Fluid was found in the peritoneal cavity. The enormously distended intestines were punctured and relieved of gas. The small intestines were found twisted on the mesentery from *left* to *right*, involving nearly all the small intestine. The intestine was untwisted, but retained its black-greenish color (gangrenous), and death occurred the next day.

CASE 9. *Operation; death*.—Reynier reported in 1898 the case of a female operated on by his assistant some time before for symptoms of intestinal obstruction. A torsion of the mesentery was found, and it was necessary to remove the entire mass of intestines from the abdomen before they could be untwisted. The patient died.

CASE 10. *Operation; death*.—Reynier's second case was a woman, aged fifty years, operated on by him in 1896, seven days after the attack began, with distention, tympanites, and vomiting. He thought at first it was a case of occlusion of the large intestine by a neoplasm. On opening the abdomen the small intestines were found distended, and, searching for the cause of obstruction, a band was found in the right iliac fossa, under which the entire mass of intestines was engaged. He at first thought it was a retroperitoneal hernia, but on drawing on

the band he recognized a twist of the mesentery from *right* to *left*. It was necessary to deliver the intestines from the abdomen in order to untwist them. The veins of the intestines were gorged with black blood, and the intestines were in a gangrenous condition. Death was the result.

CASE 11. *Operation; death*.—Kirmisson operated, March 14, 1898, on a boy, aged seven and a half years, who was taken on March 2 with constipation, pain, and vomiting. He got better, and was taken again, March 10, with the same symptoms, and next day there was fecal vomiting. There was no swelling or tympanites of the abdomen, but on the fourteenth day he was much worse, with weak, rapid pulse. The abdomen was opened, the intestines found contracted, the mesenteric veins distended, and a twist of the mesentery was taken for the ligament of Treitz, the true condition not being recognized, and the abdomen was closed. Death resulted.

The necropsy showed a complete torsion of the mesentery from *left* to *right*—about 360 degrees—easily untwisted by turning it in the opposite direction.

CASE 12. *Operation; recovery*.—F. J. Shepherd operated, May 9, 1898, on a man, aged twenty-seven years, who had been taken suddenly ill two days before with severe pain just below the navel, and vomiting, which continued. Purgatives had no effect. On admission, pulse 140, temperature 97½° F.; abdomen somewhat distended and tender. Scar of appendectomy done two years before, with a small hernial protrusion, was seen. Laparotomy gave exit to a quantity of reddish serum, and dark-colored coils of intestine presented. Two bands were divided—evidently from the old appendicitis—and the *whole* mesentery was found twisted from *left* to *right*. It was untwisted, the wound closed, with drainage, and the patient recovered.

CASE 13. *Operation; death*.—Delbet reported, June 15, 1898, two cases of torsion of the mesentery. Case 1 was a woman, operated on nine days after the first symptoms of intestinal obstruction. She was very weak, with a greatly distended abdomen, which suggested volvulus of the sigmoid flexure; but this was found collapsed, likewise the cæcum. The last coil of small intestine was empty, and on tracing it upward it suddenly bent in and disappeared behind a tense peritoneal fold with a prominent border, upon which the intestine curved from right to left and from above downward. On following it with the finger the impression was given of entering a cavity, which suggested a retroperitoneal hernia. On lifting up the mass of distended intestines a coil of distended intestine was seen by the side of the last coil of collapsed intestine, both engaged behind the sharp border of the peritoneal fold—a circumstance which strongly suggested retroperitoneal hernia. There was apparently a sharp peritoneal fold bounding an opening in which were engaged two coils of intestine—the one distended, the other empty. Traction on the superior, distended, end, in order to reduce the hernia, permitted a slight lengthening, but failed to change the appearance. Traction on the lower, empty coil had no effect. The finger introduced behind the band showed that it was not a ring, and the strangulation seemed due rather to a bend than a constriction. It was impossible to understand the cause which prevented reduction. The coil seemed fixed in the depths. Not understanding the condition, and the state of the patient not permitting further manipulation, an

anastomosis was made between the collapsed and distended coils. The patient died some hours later. The necropsy showed that the anastomosis had been made between two extreme coils of the small intestine—the first coil of the jejunum and the last coil of the ileum. It was finally ascertained to be a torsion of the entire small intestine (mesentery) a little more than a fourth of the way around, as the hands of a watch move. Matters were easily corrected by torsion in the opposite direction.

CASE 14. Operation; death from pneumonia.—Delbet's second case was a man, aged sixty-nine years, who was taken suddenly ill, January 30, with violent abdominal pain, especially in the right side; then vomiting and tympanites of the abdomen. Temperature, 37.4°C .; pulse, 100. Laparotomy was done in the evening, about ten hours after the attack began, making the incision below the navel. A quantity of fluid escaped, having the color of that which is seen in strangulated hernia. The small intestine was distended and dark red in color. After enlarging the incision and allowing part of the intestine to escape, the last coil of the ileum was seen collapsed, twisted, and fixed under a peritoneal fold, together with another small coil, red and strongly distended. The ileum, stretched between the cæcum and the peritoneal fold, was immovable, and flat against the posterior wall of the abdomen. The other coil was movable in the middle, one end engaged with the ileum behind the peritoneal fold, and could be easily moved, while its other end, which passed beneath another fold of peritoneum, was fixed. Between the two ends of this distended intestine the mesentery appeared visibly twisted. It was evidently a torsion of the entire mesentery from *right* to *left*. Evisceration was done at once, and the enormous mass of distended intestines was wrapped in hot cloths and lifted up to stretch the mesentery, which was then untwisted by a motion from above downward and from left to right, making a turn and a quarter before the intestines assumed their normal position. The wound was closed, and the patient's condition was good—pulse 90 and temperature 36.8°C .; but bronchopneumonia set in two days later, affected both lungs, and death occurred eleven days after the operation from pneumonia.

CASE 15. Operation; death.—John Homans reports in the *Boston Medical and Surgical Journal*, September 29, 1898, page 315, a case of complete torsion of the whole of the small intestine. He said it was the first case he had ever seen, and had heard of only one case since.

A female, aged seven years, was taken, March 24, with pain in the stomach, bowels did not act, pain continued next day, and she vomited. On the 26th she vomited again and kept her bed. There was distention, tympanites, and tenderness at the epigastrium. A band could be felt in the left inguinal region, irregular in shape, and a hard mass was felt with the finger in the rectum. Diagnosis: intestinal obstruction, probably intussusception; and laparotomy in the linea alba, March 29th. Dark-colored fluid escaped on opening the peritoneum, and the small intestine, of a dark purple color and distended, protruded. The entire small intestine was found twisted from *right* to *left* on its mesenteric root. A diverticulum (Meckel's) was found attached. The mesentery was untwisted and the intestines aspirated, removing some gas and liquid fecal matter. They were returned with difficulty and the wound closed, with drainage. Vomiting continued after the operation,

and death occurred at the end of twenty-four hours. Necropsy showed acute peritonitis and patches of gangrene on the intestine.

CASE 16. *Operation; death.*—In March, 1899, Delore operated on a man, aged fifty-eight years, who had been taken, four days before, with gradual symptoms of intestinal obstruction, constipation, and tenderness of the abdomen, but he continued at work; then vomiting, becoming fecal, set in, and he was sent to the Hotel Dieu. On the day of the operation the pulse was 120 and temperature 38.6° C. On opening the abdomen turbid fluid escaped. The small intestine was much congested and distended. There was peritonitis, the intestines were fixed, and it was impossible to trace the ileum to the cæcum. It did not seem to be retrosigmoid or retrocæcal hernia. Some bands were found and divided, but they did not relieve, and the wound was closed without finding the cause of the obstruction. The patient died the next day.

The necropsy showed almost the entire ileum twisted twice around its mesentery, as the hands of a watch, from right to left, and the parts were in a condition of gangrene.

CASE 17. *Operation; death.*—Major Debrie, of the French army, operated, January 12, 1900, on a soldier who was taken on the 10th with general colicky pains in the abdomen, great weakness, and constant attempts to vomit. No stool for forty-eight hours. Temperature had been 38.2° C.; pulse rapid and feeble. On the day of the operation, temperature, 37.4° C.; pulse, 106; vomiting bilious, but not fecal. Abdomen very much distended and tympanitic. Thinking it might be appendicitis, chloroform was given and the abdomen was opened in the right iliac fossa. A red, turbid liquid escaped, and the intestines were so distended as to be kept in with great difficulty. The appendix was normal, and the patient's condition required arrest of the operation. The wound was partly closed, leaving in a gauze drain. Next day (13th), pulse, 120; temperature, 37.6° C.; no passage from bowels of stool or gas; patient more quiet. On the 14th patient passed some gas; nausea, but no vomiting. Death on the 15th.

Necropsy. The mesentery was found twisted on its axis from *left to right*, compressing the ileum two inches from the cæcum at one point, and completely cutting off its communication with the cæcum, and again in the upper part of the ileum, about three-quarters of the ileum being cut off from the rest of the intestine. The intestine above was distended; that included in the mesenteric torsion was dark colored and gangrenous.

CASE 18. *Operation; death.*—Morestin operated, March 22, 1900, on a man, aged forty-four years, who had been taken suddenly ill the day before with severe pain in the abdomen, vomiting, and obstinate constipation. At the time of the operation the temperature was normal, pulse 110, and the abdomen distended and tympanitic, especially in the subumbilical region. The intestines were much distended, and, as nothing definite could be found, evisceration was done, when a twist of the entire mesentery from *left to right* was seen. It was untwisted by rotating it from right to left, relieving the obstruction, as shown by the cæcum filling with gas. The wound was closed, but death occurred six hours later.

CASE 19. *Operation; resection; death.*—Küster operated, May 14, 1900, on a man, aged fifty years, and found rotation of almost the

entire small intestine around the root of the mesentery. It was untwisted and a segment of gangrenous intestine was resected. Death resulted.

CASE 20. *Operation; recovery.*—Major C. L. Williams, of the Indian Medical Service, operated, in February, 1901, on a male coolie, aged about thirty years, who had been sick just twenty-one hours with abdominal pain coming on suddenly in the night. A boggy mass was felt in the rectovesical space by means of the finger in the rectum. The mesentery had made one-half turn (180 degrees) from *left to right*, and was fairly easily untwisted. Recovery followed.

CASE 21.—See page 802.

II. (A) VOLVULUS IN PART.

CASE 1. *Operation; recovery; return of symptoms; second operation; recovery.*—A man, aged thirty-one years, was operated on at Basle, May 6, 1887, for symptoms of acute intestinal obstruction which came on two days before. On admission, patient was collapsed, cyanotic, pupils dilated, pulse small, abdomen slightly distended, and between the ensiform cartilage and navel a tender *swelling* could be felt.

Laparotomy over this swelling showed a volvulus of the small intestine, one-half turn (180 degrees) of the mesentery. It was untwisted, and two abrasions were seen at the point of torsion.

The patient recovered, but returned on account of constipation, pain in the abdomen, and vomiting, and a second laparotomy was done in the scar of the old one. The great omentum was adherent to the wound of the abdominal wall, and a foot of the mesentery was found attached by a band to the abdominal wall, producing some kinking. The adhesions were dissected loose, the abdomen closed, and the patient recovered.

Sublimate solution, 1:5000, was used in the first operation to disinfect the peritoneal cavity.

CASE 2. *Operation; death.*—J. C. Warren operated, August 8, 1887, on a man, aged fifty-two years, who had suffered at times from colic for three or four years. About three weeks before operation he was taken with pain in the epigastrium and back; bowels at first regular, then loose; *no vomiting at any time*. August 8th he became worse, with rapid pulse and great pain about the navel. There was general distention, but a deep-seated, resistant *tumor* as large as an infant's head could be felt near the navel. Median incision over this tumor showed it to be a twisted coil of small intestine, about nine or ten inches long, about the beginning of the ileum. Considerable bloody fluid escaped from the abdomen. The volvulus was untwisted with some difficulty and the wound closed. Death next day.

Necropsy. Incipient peritonitis; mesentery greatly thickened, the veins thrombosed, but bowel in good condition.

CASE 3. *Appendix involved in the torsion; operation; recovery.*—J. Nicolaysen, of Christiania, operated, September 30, 1889, on a man, aged twenty-seven years, who was taken sick on the 25th (five days before), with severe pain in the lower part of the abdomen. The pain left after a short time and came on again on the 29th, with great severity, below and to the left of the umbilicus. There was vomiting, and the abdomen was tensely contracted and tender, especially in the

right iliac region, in which a *tumor-like* resistance was felt. Pulse, 50 to 60; respiration, 30. On opening the abdomen below the navel bloody fluid escaped, and a distended, discolored coil of small intestine appeared, twisted from *left to right* about 180 degrees, with the vermiform appendix drawn with it, and forming a tense cord about the twisted point. By turning the coil in the opposite direction the strangulation was relieved, and the appendix returned to its normal position. The appendix was removed and the abdomen closed. Recovery followed.

Within a year following this patient had two attacks of pain in the bowels, vomiting, and obstruction of the bowels, from which he recovered with the aid of medicinal treatment.

CASE 4. *Torsion of the mesentery caused by a tumor of the mesentery.*—Charles K. Briddon operated, October 13, 1892, on a girl, aged fifteen years, sick four days. She was taken suddenly with violent abdominal pain and vomiting, which kept up four days. No bowel movement for seven days. Abdomen tympanitic, moderately distended, and tender. Dulness on the right side. Pulse, 102; temperature, 100° F.

Abdomen opened on the right side. Brownish, discolored serum escaped, and a "large coil of moderately small intestine presented, which was of a dark purplish maroon color, and on separating this from other coils a bright yellow tumor came into view, measuring nine inches in circumference." This was found to be a sessile lipoma growing in the mesentery and encroaching on the surface of the bowel for about three-quarters of an inch. There was a twist of the mesentery which appeared to have been caused by axial rotation of the mass. The tumor was enucleated, and the patient recovered.

CASE 5. *Traumatic volvulus; operation; recovery.*—G. R. Turner reported, October 24, 1892, the case of a boy, aged seven years, who fell some twelve feet into the mud, striking against the pole of a boat. Collapse soon followed, with vomiting; then restlessness, pain, and tenderness in the right iliac fossa. The vomited matter became fecal. The abdomen was opened twenty-four hours after the accident. A tangled mass of intestines (ileum) was to the left of the middle line, and when this was unravelled two collapsed parts, a foot and two feet in length and separated from one another by about four feet of intervening intestine, were found. The collapsed gut at either end passed abruptly into the healthy intestine. Mr. Turner regarded it as a case of volvulus caused by injury. Uninterrupted recovery followed.

CASE 6. *Traumatic volvulus; death.*—Dr. Hawkins mentioned the case of a woman who died with symptoms of acute intestinal obstruction after a slight blow on the abdomen, and the necropsy showed a figure-of-eight twist of the gut behind the umbilicus, which unravelled itself as soon as exposed.

CASE 7. *Traumatic volvulus; death.*—Mr. Staveley related the case of a child, aged five years, on whom a slight blow had been struck on the abdomen, followed by symptoms of acute intestinal obstruction and death within twenty-four hours. Necropsy showed a volvulus situated thirty inches from the pylorus.

CASE 8. *Volvulus; operation; recovery.*—(Reported by Morris.) Mr. Gould operated, October 2, 1894, on a woman, aged twenty-five years, taken September 29th, after eating lobster, with vomiting and severe

pain in the abdomen; these symptoms continued. The abdomen was slightly distended and tender. Resonance over the front and slight dulness in the left flank. No passage from the bowels since September 29. Temperature, 96° F.; pulse, 120; fecal vomiting of a reddish-yellow color. Abdomen opened below the navel. A volvulus of the small intestine was found, the coils being congested and purple. It was untwisted, and the patient recovered and was discharged October 23d.

CASES 9 and 10. *Volvulus; operation; recovery.*—R. C. Kirkpatrick operated on two cases: (a) Operation, November 19, 1894, on woman, aged thirty years, sick three days with pain and vomiting. For a week previous she had cramps. There was constipation; abdomen was tense, slightly distended, and tender to pressure. Temperature, 100° F.; pulse, 78. A volvulus of three feet of small intestine was found, untwisted, and recovery followed. (b) Man, aged nineteen years, operated on April 21, 1894. He was taken sick the same day, with swelling of the abdomen, pain, symptoms of collapse; no vomiting. Operated on in the evening. No peritonitis. A volvulus of eight inches of small intestine was found, with a deep constriction at each end. It was untwisted, and recovery followed.

CASE 11. *Volvulus caused by straining; resection; death.*—C. B. Lyman operated, October 31, 1895, on a woman, aged thirty years, who was taken sick the day before after doing some heavy lifting. There was pain in the bowels, constipation, and vomiting. The abdomen was tender, and a mass could be felt below and to the right of the navel. At the time of operation—about thirty hours after the attack came on—the pulse was 130, thready, and irregular; the extremities cold. A median incision was made below the navel, when a mass of intestine, black in color, presented. An attempt to untwist it failed, and twenty-seven inches were resected and the ends united by means of a Murphy button. Death occurred before morning. Necropsy showed that a coil of ileum had been twisted, the lower end of the loop being three inches from the cæcum.

CASE 12. *Traumatic volvulus; operation; recovery.*—W. P. Giddings operated, February 5, 1899, on a boy, aged fifteen years, who had a fall three days before, and was seized one hour later with abdominal pain, obstipation, and vomiting. The day of operation the abdomen was distended, tympanitic, and tender; pulse, 108, thready; temperature, 97.5° F. On opening the abdomen about 1000 c.c. of bloody fluid poured out; beginning peritonitis was evident. After removing one-half of the small intestine the twist in the mesentery was found and untwisted. The abdomen was closed without drainage, and recovery followed.

CASE 13. *Volvulus; operation; recovery.*—J. T. J. Morrison reports, in 1897, the case of a fat woman, aged fifty-three years, taken three days before the operation with severe pain in the bowels, obstipation, and vomiting, which became stercoraceous. No hernia.

On opening the abdomen a large quantity of offensive bloody fluid escaped, and a greatly distended coil of small intestine appeared. This loop was about sixteen inches long, seemed to be the ileum, and was twisted around its mesenteric axis from *left* to *right*. The bowel was deeply congested and ecchymosed, but it was untwisted and returned, the abdominal cavity mopped out, and the wound closed without drainage. Recovery followed.

CASE 14. *Congenital volvulus; perforation of the intestine above the obstruction: sigmoid anus; death.*—L. Tissier and R. Mercier reported, in 1897, the case of a female infant, perfectly developed, born September 28th, and who, two days later, became restless, refused to nurse, and began to vomit. The abdomen became distended. Temperature, 36.2° C. Patulous anus; but it was thought that the sigmoid was undeveloped, and operation for artificial anus in the left iliac region was made October 2d. On opening the abdomen a mass of small intestines with a large mesenteric pedicle came out. They were quite red and distended with gas, but contained no meconium. The patient died October 5th, the vomiting having persisted.

Necropsy. General peritonitis, with intestinal contents in the peritoneal cavity. The entire large intestine was empty and about the size (less) of an adult ureter; and 25 cm. from the cæcum there was a sudden torsion of the ileum, the part below ascending in front, the portion above returning below and behind, the two portions making between them an angle of 180 degrees from *right* to *left*. Higher up the intestine was distended, and had given way by a gangrenous slough about the size of a half-franc piece; 40 cm. above was a second torsion, probably due to traction on the distended part.

From December, 1895, to December, 1898, H. Littlewood operated on 7 cases of volvulus—4 of the large intestine and 3 of the small intestine. There were three recoveries—2 of the large and 1 of the small intestine. None of the cases involved the entire mesentery. Only those of the small intestine are given here.

CASE 15. *Volvulus; operation; recovery.* (a)—Operated on June 9, 1897, on a woman, aged thirty-two years, taken sick June 3d with pain in the abdomen; later with obstinate constipation, vomiting, and abdominal distention. Pulse 150 and full. Ether was given and the abdomen opened in the middle below the navel. Three or four ounces of foul-smelling red liquid escaped. Some coils of small intestine were dark purple in color, distended and adherent to other coils. Fourteen inches of small intestine were found twisted from *right* to *left* on its mesenteric axis, making rather more than one complete turn. It was untwisted, and, though deeply grooved, was left and placed next the incision, which was closed, with drainage. The patient had thrombosis of the right femoral vein, and three days after the operation (June 12th) a fecal fistula formed in the wound, and on the 24th a foot of decomposed small intestine, in the form of a slough, was removed through this opening. She recovered except for the artificial anus, which was closed by a laparotomy and paring and uniting the edges, August 11th. Complete recovery.

CASE 16. *Volvulus; operation; death.* (b)—Operated May 5, 1898, on a man, aged fifty-three years, sick since April 29th with abdominal pain, vomiting, and abdominal distention, more marked on the left side. Temperature not above normal, but pulse 130. No tumor could be felt. On opening the abdomen blood-stained fluid escaped; purplish-colored, distended intestines were pulled out, and a volvulus involving several feet of small gut was found, the twist being from *left* to *right* on its mesenteric axis, a little more than one complete turn. There was one ulcer in the mesentery at the twisted point. It was

untwisted, but as it remained distended it was incised and a Paul tube was inserted. Abdomen closed, with the intestine fixed in the edges of the wound. The obstruction seemed relieved, but the patient died five days later. No necropsy.

CASE 17. *Volvulus; operation; death.* (c)—Operated March 16, 1898, on a man, aged twenty years, taken suddenly ill on the 13th, three days before, in the night, with acute pain about the umbilicus, which continued with vomiting, offensive in character; bowels not opened since the 11th. Abdomen slightly distended, rigid; no tumor. A *doughy sensation* in the pelvis on rectal examination. Under ether the abdomen was opened in the middle line below the navel; some peritonitis; intestines collapsed in the pelvis; distended above. A volvulus of two or three feet was found, the small intestine being twisted from *left to right* on its mesenteric axis one turn. It was untwisted and the intestine torn in doing so, but the rent was closed. Patient died on the 18th.

Necropsy showed the small intestine enormously distended over its upper half. The lower four feet formed a partially untwisted volvulus and presented dark, semigangrenous patches.

CASE 18. *Volvulus; operation; recovery.*—Dr. John Rogers (reported by Dr. Elliot, Jr.) operated, July 12, 1897, on a man, aged thirty years; sailor; sick three days with severe abdominal pain, vomiting, and great prostration. Temperature slightly elevated; pulse 120 and feeble. Abdomen swollen and tympanitic, especially in the left iliac fossa. Incision in the median line opposite or through the navel gave exit to bloody serum; small intestine congested. Volvulus found in the lower part of the ileum, which was easily corrected. Vitality of the gut unimpaired. Wound closed without drainage, and recovery followed. Bloody stools followed during the next forty-eight hours especially and somewhat for two weeks.

CASE 19. *Volvulus; operation; death.*—Dr. A. B. Johnson, in 1898, saw a case of volvulus in a child, aged six years, male, sick three days with pain, abdominal distention, vomiting, and rapid pulse. The abdomen, opened in the middle, revealed a volvulus involving about one foot of the intestine about six feet from the cæcum. The part included in the twist was gangrenous, and was resected and an anastomosis made. Death next day. It was found that gangrene extended some distance beyond the section.

CASE 20. *Chronic volvulus; resection; recovery.*—Hadra reported, in 1899, the case of a woman, aged twenty-six years, who had suffered very much for four or five years with the left side of the abdomen, painful at all times, but worse on stooping or bending; a feeling of nausea frequently, bowels more or less regular, tenderness on pressure over the left rectus muscle, and a feeling of resistance opposite the umbilicus, and a *slight swelling* was felt.

Laparotomy over this point disclosed a loop of small intestine double the calibre of the parts above and below, with much thickened walls. At either end was a distinct line of demarcation or circular impression. This coil was quite congested. It was evidently a volvulus, and was resected and a Murphy button put in. The button passed by the twelfth day, the patient recovered, and was free from all her trouble.

CASE 21. *Volvulus; operation; death.*—Dr. Brown saw, in 1899, a colored woman, aged sixty years, who had suffered seven days from

acute intestinal obstruction. On admission the abdomen was enormously distended, and there was fecal vomiting. Suspicion that obstruction was caused by uterine fibroids led to opening the colon in the right lumbar region, without relief; so another opening in front, above the navel, disclosed bloody serum, flakes of lymph, and a volvulus of the small intestine. It was untwisted, and was followed by a gush of fecal matter from the colostomy wound. Death in eighteen hours.

CASES 22 and 23. *Operation on both; both fatal.*—Elosu reports two cases of torsion of part of the mesentery occurring in the service of Lannelongue in March and August, 1900. In one the mesentery had made three revolutions on its axis. Both were operated on, 90 cm. of intestine being resected in one. Death in both cases.

(B) VOLVULUS IN PART, ASSOCIATED HERNIA.

CASE 24. *Femoral hernia, with volvulus in the abdomen; operation; death.*—Dupuytren operated, in 1819, on a woman, aged seventy-four years, with a left femoral hernia larger than two fists, which had been strangulated twelve days. Taxis had failed. After opening the sac he was still unable to reduce the intestine. Symptoms persisted for two days; the intestine became gangrenous and was incised. There was no relief, and the patient died.

Necropsy revealed adhesions between the coils forming the hernia, and a figure-of-eight crossing in the bowel just before it passed under the femoral arch, the descending passing beneath the ascending portion.

CASES 25 and 26. *Inguinal hernia, with volvulus in the sac; death.*—Zuckerkandl reported, in 1887, two cases of scrotal hernia—one right, the other left—in men, aged, respectively, fifty and sixty-four years, complicated by torsion of the mesentery in the hernial sac. One was operated on, and both died.

CASE 27. *Femoral hernia, with volvulus in the abdomen; death.*—L'Honneur reported, in 1856, a case of femoral hernia in a woman. The hernia was reduced, but the woman died in half an hour.

The necropsy revealed a loop of intestine three or four feet long, commencing three feet from the duodenum, twisted upon itself.

CASE 28. *Inguinal hernia, with volvulus in the sac; operation; death.*—Dr. Cabot, in 1857–58, reported the case of an elderly man who had a reducible inguinal hernia, for which he wore a truss. It came down during the night, and he was unable to reduce it, and there was pain in the abdomen. Nine or ten hours later he was almost pulseless, and the tumor was about the size of a foetal head, tense, cedematous, blue, and cold. Operation revealed a large amount of intestine twisted entirely round upon itself and in a state of complete strangulation. Death occurred before next morning.

CASE 29. *Femoral hernia, with volvulus in the abdomen; death.*—Laugier operated on a case, reported in 1860, of a woman, aged forty-nine years, who had suffered six days from a strangulated femoral hernia, and found gangrenous bowel, which was opened; but the patient was not relieved, and died eight days after the operation.

Necropsy showed general peritonitis and a volvulus of the lower part of the ileum from *left to right* for one complete turn.

CASE 30. *Double inguinal hernia, with volvulus; operation; death.*—J. K. Fowler reported, in 1883, a case operated on by Hulke. A man, aged forty years, who had worn a truss for years on account of a double inguinal hernia, was taken with symptoms of intestinal obstruction. A volvulus of the small intestine was found. Death occurred three days later. The necropsy showed about eighteen inches of ileum near the cæcum, congested and diseased. The whole mesentery was very long—from seven to eight and a half inches from the spine to its intestinal attachment.

CASE 31. *Inguinal hernia, with volvulus in the sac; operation; death.*—C. J. Symonds reported, in 1889, the case of a man, aged seventy-two years, who had had a right inguinal hernia fifty years. It became painful one day, he vomited the next, and herniotomy showed a good deal of omentum in the sac, with a volvulus of the small intestine. This was reduced, but the patient died unrelieved.

Necropsy. No general peritonitis, but thirty-nine inches from the cæcum was a coil of ileum nine and a half inches long, in parts gangrenous, which had evidently formed the volvulus.

CASE 32. *Retroperitoneal hernia, with volvulus; death.*—J. Jackson Clarke reported, in 1893, a case of duodenal (retroperitoneal) hernia in a man who was taken suddenly ill with pain which caused him to fall in the street. At the necropsy Mr. Page found almost the entire small intestine in the hernia. About a foot of the upper part of the ileum was deeply congested—probably the result of having been twisted in the sac. The rest of the small intestine was normal in appearance.

CASE 33. *Double inguinal hernia, with volvulus in the sac; operation; recovery.*—J. T. J. Morrison operated, October 1, 1894, on a man, aged thirty-eight years, laborer, who had had a double inguinal hernia for several years, for which he wore a truss. During a fit of coughing the left side increased very much in size, with agonizing pain bordering on collapse, but no vomiting. Operation five hours later. Blood-stained fluid escaped on opening the sac, and about a yard of small intestine, which was only slightly congested; but another coil, about twelve inches long and very dark in color, was seen deep in the sac. This loop was twisted around its mesenteric axis, and was evidently the cause of the acute symptoms and blood-stained fluid. The intestine was untwisted, reduced, and the radical operation for cure performed. Recovery followed.

CASE 34. *Retroperitoneal hernia, with volvulus; operation; recovery.*—Neumann reported, in 1897, the case of a woman, aged fifty-five years, who was taken, six days before operation, with sudden cramps in the abdomen, vomiting which became stercoraceous, and obstinate constipation. Abdomen moderately distended and tender. Operation disclosed a right duodenal hernia, the sac containing the bowel lying to the right of the spinal column, and forming a tumor larger than a child's head. Part of the intestine was withdrawn by traction on the lower part (ileum), when it suddenly ceased, and examination showed a loop of bowel twisted into a pedicle. It was untwisted with difficulty in the sac and withdrawn. It was about half a metre long, blackish-blue in color, surface dull in places, and the mesentery was oedematous and contained infarcts. Recovery followed.

CASE 35. *Umbilical hernia, with volvulus in the abdomen; death.*—R. L. Knaggs operated, May 17, 1897, on a woman, aged sixty-two

years, with a large strangulated umbilical hernia. She was taken the day before with intense pain in the hernia and vomiting. Operation six and a half hours after the attack began. Pulse 54 and of good volume. Blood-stained fluid and several feet of small intestine, distended and black with blood, were found in the sac. There was no constriction at the hernial ring. The opening was enlarged and the intestines withdrawn until healthy bowel was reached; then a volvulus involving between four and six feet of small intestine was found and released by a half turn and the intestine returned. The patient had some relief, and passed feculent matter and sanious fluid, but death occurred after forty hours. No necropsy.

CASE 36. *Scrotal hernia, with volvulus in the abdomen; operation; death.*—R. L. Knaggs operated, October 4, 1898, on a man, aged fifty-six years, who had long suffered from a left irreducible inguinal hernia. He was taken thirteen hours before with pain in the umbilical region, followed by vomiting, swelling of the hernia, and seven or eight hours later the passage of a quantity of bloody fluid and clots. Pulse 84.

On opening the sac, dark fluid and about three feet of small intestine were found—a part almost normal and the other part congested and covered with bloody fluid. The trouble was not at the abdominal rings, and the finger introduced detected something like a band inside. The intestine was drawn down until it became healthy, when a constricted point was found. As the patient's condition was bad, the intestine was reduced, in the hope that the volvulus would untwist, and the wound was closed. Death occurred twenty-seven hours later.

The necropsy showed that the lowest four feet had made a single half turn from right to left, "so that at the neck of the volvulus the termination of the ileum lay over and directly across the ileum at a point some feet above the valve." The greater part of the loop had been in the hernial sac. Cause of death suggested was shock and fecal intoxication.

CASE 37. *Femoral hernia, with volvulus; resection of gangrenous part; recovery.*—Dreesman operated, May 7, 1898, on a woman, aged thirty-seven years, with a right femoral hernia. She was taken the day before with pain, swelling of the hernia, which became as large as two fists and tender, and vomiting. Pulse 160. On opening the sac dark-colored fluid escaped, the intestine was gangrenous, and the gangrenous portion extended into the abdomen and could not be drawn out. The abdomen was opened by extending the hernial incision, when more dark fluid escaped, and a volvulus of the lower part of the ileum, from right to left, one half turn, was found. About 7 feet (2.15 metres) of gangrenous intestine were resected and the proximal end inserted laterally into the colon. Recovery followed.

CASE 38. *Inguinal hernia, with volvulus in the sac; operation; recovery.*—J. C. Da Costa reported, in 1899, the case of a man, aged forty-nine years, with an old, very large inguinal hernia, which nothing would retain in place. Three days before operation there had been pain in the hernia and in the abdomen, tenderness and nausea, but no vomiting. The sac contained the cæcum, appendix, most of the ascending colon, and a considerable portion of the ileum and omentum. A portion of the ileum was found twisted, adherent to surrounding structures, deeply congested, and strangulated. The omentum was removed, the intestines reduced, and the patient recovered.

CASE 39.—See page 803.

CASE 40. *Femoral hernia, with volvulus in the abdomen; death.*—This patient, seen by me, was a white woman, aged sixty-two years, who had had a left femoral hernia many years. It came down on the night of April 24, 1902, and she was unable to reduce it. Next day she was in pain, and began to vomit. When I first saw her, on the 26th, the abdomen was soft, not swollen, but was tender, as was the hernia. Pulse 120, and vomiting was stercoraceous. Patient refused operation, and died about forty-eight hours after the first symptoms appeared. Necropsy showed slight peritonitis, but considerable effusion of dirty yellow serous fluid. The hernial sac contained about one inch of gangrenous ileum about twelve inches from the cæcum, tightly constricted by the femoral ring. Within the abdomen was a distended coil of intestine continuous with the portion in the hernial sac. The coil formed a volvulus about two feet long by turning on its mesentery from right to left a half turn, and was held in place by the hernia. Reduction of the hernia permitted the volvulus to untwist.

REFERENCES.

- Bassinot, E. G. Thesis, de l'Occlusion intestinale par Torsion totale du mésentère, Paris, 1900, 8°.
- Browne, W. R. Trans. Indian Branch British Medical Association (1893-95), Madras, 1896, vol. v. pp. 5-9.
- Briddon, C. K. Annals of Surgery, 1893, vol. xvii. p. 63.
- Burrell, H. L., and Bottomly, J. T. Med. and Surg. Reports Boston City Hospital, 1896, p. 123.
- Debrie, E. J. Archiv. de méd. et pharm. militaire, Paris, 1900, vol. xxxvi. p. 324.
- Elliot, E. Jr. Annals of Surgery, 1899, vol. xxx. p. 47.
- Elosu, F. Thesis, de l'Occlusion intestinale par Torsion mésentère, Bordeaux, 1900, 8°.
- Fabre, E. Thesis, de l'Occlusion intestinale par Torsion mésentère, Lyons, 1898, 8°.
- Feliciani, J. Gaz. med. di Roma, 1894, vol. xx. p. 301.
- Fowler, J. K. Proceedings Medical Society, London, 1884, vol. vi. p. 343.
- Giddings, W. P. Boston Med. and Surg. Journ., 1900, vol. cxliii. p. 160.
- Grol, L. Thesis, De Volvulo, Hardevico, 1765, 4°.
- Hadra, B. E. Texas Medical Journal, Austin, 1899-1900, vol. xv. p. 195.
- Homans, J. Boston Med. and Surg. Journ., 1896, vol. cxxxix. p. 315.
- Hunter, G. H. Lancet, London, 1899, vol. ii. p. 483.
- Kirkpatrick, R. C. Montreal Medical Journal, 1895-96, vol. xxiv. p. 270.
- Knaggs, R. L. Annals of Surgery, 1900, vol. xxxi. p. 405.
- Küster, E. Berlin. klinisch. Wochenschrift, 1900, vol. xxxiv. p. 941.
- Littlewood, H. Lancet, London, 1899, vol. i. p. 428.
- Lyman, C. B. Colorado Medical Journal, Denver, 1896, vol. ii. p. 139.
- Morris. Middlesex Hospital Report, London, 1894, p. 141.
- Morrison, J. T. J. Birmingham Medical Review, 1887, vol. xlii. p. 288.
- Nicolaysen, J. British Medical Journal, London, 1892, vol. ii. p. 170.
- Rogers, A. W. Trans. Medical Society of New Jersey, Newark, 1888, p. 248.
- Rolleston, H. D. Trans. Path. Soc., London, 1889-90, vol. xli. p. 129.
- Senn, N. Medical News, Philadelphia, 1889, vol. lv. p. 590.
- Shepherd, F. J. Montreal Medical Journal, 1899, vol. xviii. p. 46.
- Thomson, G. R. Glasgow Medical Journal, 1899, vol. lii. p. 119.
- Tissier and Mercier. Bulletin et mémoire Soc. Obstet. et Gynecol. de Paris, 1897, p. 269.
- Turner, G. R. British Medical Journal, London, 1892, vol. ii. p. 944.
- Vaux, F. L. Canada Lancet, Toronto, 1896-97, vol. xxix. p. 59.
- Warren, J. C. Boston Medical and Surgical Journal, 1888, vol. cxix. p. 380.
- Williams, C. L. Indian Medical Gazette, Calcutta, 1901, vol. xxxvi. p. 457.
- Zuckerkindl, O. Allgemein. Wein. med. Ztg., 1887, vol. xxxii. p. 633.
- Jahresbericht u. d. chir. Abth. d. Spitä. zu Basel (1887), 1888, p. 76. Ileus wegen Achsendrehung einer Dünndarmschlinge, 1 Fall.