THE TREATMENT OF ILEUS

AS INDICATED BY CLINICAL EXPERIENCE AND EXPERIMENTAL STUDIES*

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The treatment of acute intestinal obstruction is a challenge to the judgment and technical skill of any surgeon. The high mortality from this condition has stimulated intensive experimental researches over the last thirty years. It is my intention to briefly review the knowledge that has been gained from these studies; and to indicate any practical value we have found by the actual application to the treatment of acute intestinal obstruction in our clinic.

One of the most important advances is the recognition of at least three distinct types of dynamic obstruction. Much confusion can be avoided by taking cognizance of the differences between simple occlusions without damage to the blood supply or tissues; the rapid necrosis of strangulations; and possible combinations of these two states. The first of these forms is well illustrated by pyloric stenosis; the second by strangulated hernia; and the third, by adhesions obstructing a small bowel loop which cannot be emptied because of torsion or some other factor. We will return to this discussion later.

It has been found that the normal small intestinal mucosa provides an adequate defense against the absorption of any of the more toxic colloids. The simpler molecules of low molecular weight readily pass the barrier. There is thus a selective absorption which operates continuously to protect us from the many poison products of normal digestion. The poisons are either detoxified in passage through the bowel wall or are hurried along the intestinal canal and rendered inert by digestive enzymes. The normal mucosa is also impenetrable to introduced poisons of high molecular structure.[1, 2, 3] The normal bowel below an obstruction does not absorb the poisons from the obstructed loops when the obstruction is released. The normal small bowel contains small numbers of bacteria even in the higher segments.[4, 5] The continued loss of the normal secretions from the higher segments may lead to a very serious condition.[6, 7] The total loss of these secretions by vomiting or through a fistula for any length of time brings about a picture which closely parallels a high obstruction at the same level.[8]

When a small bowel loop is obstructed, there is an upset in the whole neuromuscular mechanism at least down to the obstructed point. On the motor side, peristaltic waves, originating above, attempt to pass the contents beyond the obstruction. Their ineffectiveness leads to a disturbance of the normal gradient with reversed peristalsis and vomiting.[9] If vomiting keeps

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the involved bowel empty, the simple type of obstruction similar to pyloric stenosis is produced. If by kinking or twisting the involved bowel segments are prevented from draining, another sequence of events ensues, producing the third type of obstruction, a mixture of obstruction and strangulation. Obstructed undrained intestinal loops furnish ideal conditions for bacterial growth. *Bacillus welchii,* among other bacteria, is present in most cases and increases enormously in numbers.[10, 11] There is no escape for the trapped secretions. The absorption rate from the involved area is less than under normal conditions.[12, 13] In the higher segments accumulation of secretions is by no means slow. The intra-intestinal pressure rises quickly.[14] The bacteria cause putrefaction with liberation of gas, which helps increase the distention. The fluid content of the loops becomes very foul and toxic if absorbed. The toxic properties as a rule take more than thirty-six hours to develop; after thirty-six hours the contents become very toxic.[15] If the distention inside the lumen increases beyond a certain point, the capillary circulation is stopped. Ischæmia and necrosis result, especially in the capillary distribution along the anti-mesenteric border.[16] The shorter the trapped segment, the more dangerous is this intra-intestinal pressure.[17] The secretion rate in the upper segments is considerably greater than that in the lower small bowel. Consequently, a trapped high loop develops pressure more quickly than a similar low one.[14]

It is generally conceded that there is a toxæmia with strangulation. If the circulation is shut off, the picture is more acute and death is more rapid.[17] The shorter is the strangulated segment, the more rapidly fatal the outcome.[17] Infectious and toxic intestinal wall materials in strangulation go directly into lymph channels or into the general blood-stream.[18]

It has been long debated as to whether there is a toxæmia in the simple high obstructions. The evidence seems to be increasing that toxæmia has little part in this picture. There is, on the other hand, loss of fluids and salts, by constant vomiting. Death appears to be from dehydration, demineralization and starvation.[19, 20] Animals can be kept alive and in good condition for long periods by reintroducing the vomited material through an enterostomy below the obstruction.[21] The blood-chemistry change in animals with obstruction at a definite level is decidedly different from that in animals obstructed at the same level but maintained in salt balance.[22] There is a striking similarity in the clinical picture, blood-chemical changes and life expectancy in animals with simple high obstruction and those with complete fistula at the same level. The syndrome is due to a deficiency of essential secretions through loss from the upper gastro-intestinal tract.[8]

From a practical standpoint, however, it is the part of wisdom to regard every obstruction of the intestine as a potential strangulation with impending toxæmia until otherwise demonstrated. This is especially necessary when there is a chance for failure of drainage in sagging loops. Here, the opportunity for increased intra-enteric pressure makes it possible to develop necrosis and consequent toxæmia.

The nature of the toxins in intestinal obstruction has been the subject of much work. The present-day opinion is that there is no specific toxin in obstructed gut fluid that is the cause of death.[23] There are many poisons present as the products of normal digestion or putrefaction which may be effective. If all food and normal secretions such as bile, pancreatic and gastric juice be excluded from a loop, the secretion then formed in the lumen is not toxic either on intravenous or intraperitoneal injection.[24] The presence of bacteria is essential for the formation of toxins.[24, 25] When bacteria are excluded, even autolysis of an involved segment *in vitro* or *in vivo* will not elaborate sufficient toxin to kill the animals.[25, 26] No specific antibodies are produced by repeated intravenous injections of closed loop fluid.[27] This would indicate that the toxic principles are probably not of protein nature. Every known soluble complete protein may act at least to some degree as an antigen. The entire mass of cleavage products of a protein are not antigenic.[28] There is no increase in immunity or tolerance to intestinal obstruction after recovery from a previous obstruction.[29] As the toxin is not specific in nature, the use of Welch bacillus antitoxin in therapy is not of value.[30] The toxins are quickly formed in most closed loops.[31] Large amounts of closed loop fluid can be introduced into the normal intestine without effect.[1, 2, 3] There is no evidence that toxins circulate in the blood of animals or patients dying of intestinal obstruction. The blood of such animals can be transfused into normal animals without causing any symptoms.[31] It would seem that the toxins are rapidly fixed by the tissues and only minimal quantities ever circulate.

The evidence for the pathway of absorption of the toxins is rather indefinite. Minute quantities have been demonstrated in the blood in the agonal stages of the condition.[32] The mucosa theory has been difficult to prove by experiment.[1] Many investigators agree that there is no absorption except through an injured mucosa. This they consider more essential than the formation of the toxin.[6, 17] The importance of increased intra-intestinal pressure is coming more and more to be recognized. This leads to stasis, ischæmia, and focal necrosis exposing the vascular bed.[14] Toxins can be recovered under these circumstances from the thoracic duct.[33] It is known that the vascular bed of the peritoneum readily absorbs toxins of high molecular structure.[34] The fissures and gangrenous patches allow the toxic material to come in contact with the visceral peritoneum, offering thus another method of absorption without demonstrable peritonitis.[14, 35] Emptying a distended loop full of toxic material even by the slightest manipulation causes damage to the friable mucosa, hæmorrhage, and absorption of toxin. If the loops are extraperitoneal in position, damage to them causes little effect except development of a fistula; if intraperitoneal, it quickly kills.[35] By preventing distention in a majority of instances toxæmia does not occur.[24] If pressure is taken off by aspiration of the loop, no toxicity develops and the level of the non-protein nitrogen does not increase in the blood. When normal circulation to the obstructed loop is maintained, toxins

are not taken up, or, at least, not faster than they can be handled.[23] Mounting pressure within the bowel is very important in the absorption of toxins but delays the circulation and thus slows their dissemination.[36] Pilocarpine, even in small doses, hastens the fatal termination by increasing the fluid distention in experimental animals with small bowel obstruction.[37] Symptoms of intoxication which follow release of obstructions are due to damaging of the occluded loop and absorption there, and not from the healthy bowel below.[35, 38] If one strips the small intestine of a normal animal from above down the carotid pressure sinks but recovers again and in forty-five minutes returns to its normal. When the same thing is done after an ileus of twenty-four hours' duration, the blood-pressure sinks lower than normal and shows little tendency to return. A proportion of these animals quickly die.[39] There is ample proof that death in intestinal obstruction is not due to a septicæmia or to a peritonitis. Much experimental work has disproved these theories formerly held. The occurrence of either septicæmia or peritonitis must be regarded as a complication.

Simple occlusion without damage to the blood supply or tissues such as in pyloric stenosis, if long enough continued, leads to dehydration, alkalosis, and starvation. The dehydration and alkalosis are due to the loss of water and acid through vomiting. If the loss of acid from the body is so rapid that the balance in the blood cannot be maintained, alkalosis becomes inevitable.[40] Laboratory tests on the blood will show that there is progressive diminution of the chlorides, a corresponding rise in non-protein nitrogen, and a high carbon-dioxide combining power.[7] Administration of sodium chloride prolongs the life.[7] As long as the chlorides can be kept near the normal level, the other changes in the blood do not occur.[41] Other chloride salts cannot take the place of sodium chloride.[42] Water alone is not effective in therapy.[43] The importance in supplying sodium chloride is in replacing the sodium base. Without this base fluid is lost as fast as it is given.[44]

The problem of an early simple high obstruction, then, becomes one of maintaining the normal sodium-chloride level of the blood. If there is no dehydration and no alkalosis in consequence, it is often possible to carry patients for many days, even though the obstruction is not relieved. The general condition is such that it is then possible to attack the obstruction under favorable conditions. Toxæmia is in the background or does not exist in these early simple obstructions.

Strangulation, on the other hand, is an entirely different problem. Toxæmia is the paramount issue in this form of obstruction. Dehydration, alkalosis, and starvation are of little significance, if they exist at all. Many times there is no evidence of their existence although the patient is overwhelmed by toxins. A laboratory test on the blood will show a high non-protein nitrogen, although it is best not to wait for it. The blood chlorides and carbon-dioxide combining power of the blood will show little change. Administration of sodium chloride has no effect in this form of obstruction. The problem is to remove as rapidly as possible the offending segment which

is giving rise to the toxæmia. The danger of delay is that of an overwhelming absorption of toxins; or impending rupture with rapidly fatal peritonitis. If once the toxin is widely disseminated we have no remedy that is of any value.

Long-continued undrained obstructions form a third type of intestinal ileus which combines the features of both simple and strangulation obstructions. The long-neglected loops become heavy with a very foul secretion. Distention takes place until at times the small bowel becomes enormous. Capillary engorgement and stasis of the blood supply occurs. Focal necroses develop, especially along the anti-mesenteric border. The capillary loops are exposed to the toxic material in the lumen; selective absorption is no longer effective. A toxæmia develops rapidly. Focal patches of gangrene allow peritoneal absorption of toxins as well as that through the capillary bed; or an actual rupture may occur, causing a fatal peritonitis. In this type of obstruction, dehydration, alkalosis and toxæmia are all prominent features. The problem is to supply sodium chloride and water and to remove the obstruction with as little manipulative disturbance as is consistent. This type of obstruction calls for the most careful judgment on the part of the surgeon and the patient's life depends on the wisdom of his decisions. It is most frequently seen in the forty-eight to seventy-two hours after the onset of an obstruction. If this critical period is passed without toxæmia developing, it is an indication that the loops are being effectively drained through vomiting.

The clinical cases here presented will include ileus in all its forms as related to the small intestine only, and excluding pyloric and duodenal obstruction. Paralytic ileus, partial obstruction and obstruction to the large bowel will not be considered. The operations in this series were performed by fourteen different surgeons, members of the attending and resident staff.

When a patient enters the hospital with the symptoms of acute intestinal obstruction or develops them in the hospital, we make an effort to decide whether we are dealing with a strangulation, a simple obstruction or a combination of the two. It is not always possible to decide, but in such instance we proceed on the assumption that it is the worst form. We make our diagnosis on the history and clinical examination and do not depend on laboratory studies except for localization by the Röntgen-ray.

In the simple high obstructions our plan is to restore fluids and salt balance. There is no need for haste in this type of obstruction as exemplified by pyloric stenosis. We depend a great deal on the blood-chemistry reports and guide our treatment accordingly. When the balance is restored we relieve the obstruction. The group of cases most nearly representing the simple obstruction in this report is that of obstruction at the site of a gastroenterostomy. When the operation has been done years before the diagnosis is not so difficult; but on a newly operated individual in whom some accident has occurred at the gastroenterostomy opening, it is diagnosed with great reluctance. There have been seven of these cases in our series with two

deaths, a mortality of 28.5 per cent. There should be no mortality in this group. The fatalities were due to too late diagnosis in one patient following a resection for cancer of the stomach; and to a technical error with abscess formation in the lesser sac in the second. Enteroenterostomy usually relieves these patients promptly.

Simple High Obstruction

(Excluding Pyloric and Duodenal Obstruction)

No. 6459, male, aged fifty-one years. Type of obstruction.—Posterior gastroenterostomy with kink of distal jejunal loop. Time since onset.—Recent operation. Two weeks after operation. General condition.—Poor from prolonged vomiting. Anæsthesia and operation.—Gas and oxygen, ether. Enteroenterostomy. Result.—Well.

No. 10,502, male, aged sixty-nine years. Type of obstruction.—Posterior gastroenterostomy. Adhesions about Treitz's fossa. Time since onset.—Old operation, eight years. Gradual onset two weeks. General condition.—Mitral lesion. Arteriosclerosis. Bladder obstruction. Non-protein nitrogen, 57. Anæsthesia and operation.—Scopolamine-morphine-local. Enteroenterostomy. Result.—Well. Remarks.—Enormous distention of duodenum.

No. 20,627, male, aged forty-five years. Type of obstruction.—Posterior gastroenterostomy. Adhesions about Treitz's fossa. Time since onset.—Old operation. Six to eight hours only. General condition.—Good. Anæsthesia and operation.—Gas and oxygen. Release of adhesions. Result.—Well.

No. 44,904, female, aged fifty-four years. Type of obstruction.—Posterior gastroenterostomy. Retrograde incarceration. Time since onset.—Recent operation, gradual for sixteen days. General condition.—Fair. Anæsthesia and operation.—Avertin. Enteroenterostomy. Result.—Well.

No. 47,737, female, aged thirty-six years. Type of obstruction.—Posterior gastroenterostomy. Adhesions about Treitz's fossa. Time since onset.—Old operation. Gradual for seven days. General condition.—Fair. Anæsthesia and operation.—Avertin, gas and oxygen. Release adhesions. Enteroenterostomy. Result.—Well.

No. 18,151, male, aged thirty-eight years. Type of obstruction.—Pólya type anastomosis. Obstruction from abscess. Time since onset.—Old operation. Posterior gastroenterostomy, gradual obstruction complete. General condition.—Poor. Anæsthesia and operation.—Gas and oxygen, ether. Enteroenterostomy. Result.—Died. Remarks.—Abscess lesser sac.

No. 38,174, female, aged fifty years. Type of obstruction.—Posterior gastroenterostomy with kink of distal jejunal loop. Time since onset.—Recent operation. Five to ten days post-operative. General condition.—Resected cancer of stomach. Anæsthesia and operation.—Gas and oxygen. Enteroenterostomy. Result.—Died.

In strangulations the administration of salt solution will not prove as valuable as in the simple obstructions. Here the ideal is to get the strangulated segment outside the peritoneal cavity, restoring the normal intestinal current as soon as possible. We usually do a direct end-to-end anastomosis when circumstances permit. In very desperate cases we have tried enteroenterostomy, the Mikulicz type of removal, or enterostomy alone.

There were twenty-two cases of strangulation in which there was massive necrosis of a segment of bowel. These consisted in three instances of gangrenous intussusceptions. In one, an adult with intussusception originating beside a polyp in the lower ileum, resection and end-to-end anastomosis produced a cure. Two died, one, a six months' baby brought in after three

days, too late for cure; the other, a seven months' baby who, after resection, was progressing favorably but succumbed to an accidental boric-acid poisoning. Four cases of mesenteric thrombosis all died when gangrene was present. One patient had a resection and end-to-end anastomosis. He was a seventy-year-old man who was in critical condition after two days of obstruction and there were thirty inches of necrotic ileum with a rupture of the appendix. Another man of fifty-five had endocarditis, infarction in various organs, and patchy necroses of the lower two feet of terminal ileum. An ileocolostomy was done to sidetrack the involved bowel, but the non-protein nitrogen of the blood was eighty-eight at the time of operation and he died from continued progress of his disease. A fifty-two-year-old man had his obstruction for four days and only an enterostomy was done which did not relieve him. The fourth patient was a seventy-five-year-old woman who had had obstruction for several days. She died six hours after entry without operation as she was in too critical condition to even consider it. Post-mortem examination showed mesenteric thrombosis. There were four cases of volvulus with massive gangrene, two about old adhesions; and two about Meckel's diverticuli. Three of these patients died. The two with volvulus about adhesions were too late for surgical help—coming in after three days and six days of obstruction respectively. In both instances the necrotic bowel was brought outside in a Mikulicz procedure without benefit. In one of the Meckel's diverticulum cases resection with end-to-end anastomosis was successful; in the other, there was, unfortunately, a second obstruction at the anastomosis. It was recognized too late. This death must be regarded as a surgical failure. Four cases of strangulated inguinal hernia had successful resections and anastomoses with cure. There were four cases of strangulated femoral hernia. Three were resected and anastomosed with cure; the fourth died after similar treatment. This death cannot be charged to surgery as the woman arrived after five days of obstruction with perforation, and a blood non-protein nitrogen of 75, too late for help. She had her operation under local anæsthesia but also had a complicating pneumonia post-operatively. In three cases of ventral hernia two resections were successful but the third patient died after operation in diabetic coma; an unavoidable death.

The two cases of partial necrosis were handled by inverting the gangrenous patches and reinforcing the involved area. Both recovered without incident.

Strangulation—Massive Necrosis

No. 7960, female, aged seven months. Type of obstruction—Intussusception. Time since onset.—Twelve hours. General condition.—Poor. Anæsthesia.—Drop ether. Operation.—Resection, end-to-end anastomosis. Result.—Died. Remarks—Boric-acid poisoning.

No. 42,217, male, aged six months. Type of obstruction.—Intussusception. Time since onset.—Three days. General condition.—Very poor. Anæsthesia.—Drop ether. Operation.—Resection, end-to-end anastomosis. Result.—Died. Remarks.—Too late.

No. 43,395, male, aged fifty-five years. Type of obstruction.—Intussusception, polyp. Time since onset.—Two days. General condition.—Very ill. Anæsthesia.—Gas and

oxygen. Operation.—Resection end-to-end anastomosis. Result.—Well. Remarks.—Gangrene six inches ileum.

No. 14,301, male, aged fifty-two years. Type of obstruction.—Mesenteric thrombosis. Time since onset.—Four days. General condition.—Fair; non-protein nitrogen, 60. Anæsthesia.—Local. Operation.—Enterostomy. Result.—Died. Remarks.—Enterostomy; spinal; no avail.

No. 20,791, male, aged fifty-five years. Type of obstruction.—Mesenteric thrombosis. Time since onset.—Gradual, time? General condition.—Endocarditis, non-protein nitrogen, 88. Infarction of spleen. Anæsthesia.—Gas and oxygen. Operation.—Ileocolostomy. Result.—Died. Remarks.—Patchy gangrene twenty-four inches ileum; too late.

No. 23,108, female, aged seventy-five years. Type of obstruction.—Mesenteric thrombosis. Time since onset.—Several days. General condition.—Prostrated, œdema, bad heart, dyspnœa. No operation. Result.—Died. Remarks.—Died six hours after entry.

No. 33,844, male, aged seventy years. Type of obstruction.—Mesenteric thrombosis. Time since onset.—Two days. General condition.—Critical, auricular fibrill infarction of liver. Anæsthesia.—Spinal. Operation.—Resection, end-to-end anastomosis. Result.—Died. Remarks.—Thirty inches gangrene ileum; too late.

No. 4152, female, aged fourteen years. Type of obstruction.—Volvulus, about adhesions. Time since onset.—Three days. General condition.—Very bad, peritonitis. Anæsthesia.—Gas and oxygen; ether. Operation.—Mikulicz first stage. Result.—Died. Remarks.—No chance for surgery; thirty-two inches gangrene ileum.

No. 51,485, female, aged seventy-seven years. Type of obstruction.—Volvulus about adhesions. Time since onset.—Six days. General condition.—Obese, peritonitis, non-protein nitrogen, 75. Anæsthesia.—Ether. Operation.—Mikulicz first stage. Result.—Died. Remarks.—No chance for surgery—twenty-four inches gangrene.

No. 23,574, male, aged thirty-three years. Type of obstruction.—Volvulus about Meckel's diverticulum. Time since onset.—Twenty-four hours. General condition.—Poor, non-protein nitrogen, 85. Anæsthesia.—Gas and oxygen; ether. Operation.—Resection, end-to-end anastomosis. Result.—Died. Remarks.—Second obstruction at anastomosis.

No. 7055, male, aged eleven years. Type of obstruction.—Volvulus about Meckel's diverticulum. Time since onset.—Nine hours. General condition.—Fair. Anæsthesia.—Ether. Operation.—Resection, end-to-end anastomosis. Result.—Well.

No. 8411, female, aged fifty-one years. Type of obstruction.—Strangulated ventral hernia. Time since onset.—Nine and a half hours. General condition.—Obese; severe diabetes; mitral insufficiency. Anæsthesia.—Gas and oxygen; local. Operation.—Entero-enterostomy above damaged loop. Result.—Died. Remarks.—Diabetic coma; blood sugar, 455.

No. 14,382, female, aged thirty-six years. Type of obstruction.—Strangulated ventral hernia. Time since onset.—Twelve to sixteen hours. General condition.—Obese. Anæsthesia.—Gas and oxygen; drop ether. Operation.—Resection, end-to-end anastomosis. Result.—Well. Remarks.—Twenty-four inches gangrene of jejunum.

No. 33,828, female, aged forty-nine years. Type of obstruction.—Strangulated ventral hernia. Time since onset.—Nine hours. General condition.—Extreme obesity; hypertension; asthma. Anæsthesia.—Spinal. Operation.—Resection, end-to-end anastomosis. Result.—Well. Remarks.—Six inches gangrene jejunum.

No. 6739, male, aged forty-three years. Type of obstruction.—Strangulated inguinal hernia. Time since onset.—Five hours. General condition.—Active pulmonary tuberculosis. Anæsthesia.—Local, gas and oxygen. Operation.—Resection, end-to-end anastomosis. Result.—Well. Remarks.—Eighteen inches gangrenous ileum.

No. 14,416, male, aged seventy-seven years. Type of obstruction.—Strangulated inguinal hernia. Time since onset.—Sixteen to eighteen hours. General condition.—Over 200 pounds, cyanosed, fibrillating. Anæsthesia.—Local. Operation.—Resection, end-to-end anastomosis. Result.—Well. Remarks.—Eight to ten inches gangrenous ileum.

No. 30,050, male, aged forty-nine years. Type of obstruction.—Strangulated inguinal hernia. Time since onset.—Twenty-four hours. General condition.—Fair. Anæsthesia.—Ether; chloroform. Operation.—Resection, end-to-end anastomosis. Result.—Well. Remarks.—Eighteen inches gangrenous ileum.

No. 31,394, male, aged twenty-three years. Type of obstruction.—Strangulated inguinal hernia; reduced *en masse*. Time since onset.—Forty-eight hours. General condition.—Good. Anæsthesia.—Gas and oxygen; ether. Operation.—Resection, end-to-end anastomosis. Result.—Well. Remarks.—Ten inches gangrenous ileum.

No. 12,646, female, aged forty years. Type of obstruction.—Strangulated femoral hernia. Time since onset.—Ten hours. General condition.—Good. Anæsthesia.—Gas and oxygen; ether. Operation.—Resection, end-to-end anastomosis. Result—Well. Remarks.—Seven and a half inches gangrenous ileum.

No. 16,836, male, aged sixty years. Type of obstruction.—Strangulated femoral hernia. Time since onset.—Two to three hours. General condition.—Bad heart; asthma. Anæsthesia.—Local. Resection, lateral anastomosis. Result.—Well. Remarks.—Nine inches gangrenous ileum.

No. 24,613, female, aged forty-eight years. Type of obstruction.—Strangulated femoral hernia. Time since onset.—Five days. General condition.—Bad; peritonitis. Anæsthesia.—Local. Operation.—Resection, end-to-end anastomosis. Result.—Died. Remarks.—Six inches gangrenous ileum; died pneumonia.

No. 30,659, female, aged forty-six years. Type of obstruction.—Strangulated femoral hernia. Time since onset.—Four days. General condition.—Fair. Anæsthesia.—Gas and oxygen, ether. Operation.—Resection, end-to-end anastomosis. Result.—Well. Remarks.—Eight inches gangrenous ileum.

Focal Necrosis

No. 34,720, male, aged one month. Type of obstruction.—Strangulated inguinal hernia. Time since onset.—Twenty-four hours. General condition.—Poor; malnutrition. Anæsthesia.—Ether. Operation.—Infolding necrotic area; release obstruction; repair. Result.—Well.

No. 49,204, female, aged forty-five years. Type of obstruction.—Strangulated femoral hernia. Time since onset.—Two and a half hours. General condition.—Good. Anæsthesia.—Local. Operation.—Release obstruction; infolding necrotic area. Result.—Well.

The largest number of intestinal obstructions combine the features of obstruction and strangulation. And it is to this type of obstruction that the facts determined by experimentation are most applicable. In no other kind of surgery, also, is there so much opportunity for the display of surgical judgment. In many instances the margin of safety is so small that the slightest mistake will tip the balance the wrong way. The essence of surgical success consists in doing as little as is necessary to relieve the obstruction. Among the reasons for early operation may be urged the following: There is less shock and toxæmia in handling the less dilated loops. There is less distention and the loops are not so much in the way. There is less danger of an obstructed circulation. There is less danger of rupture from manipulation. There is less dehydration and loss of salts. The patient is in better shape to more safely stand the operation. The one thing a surgeon must constantly guard against is the lure to go on doing just a little more in a complicated case. Each case is a problem in itself and no set rules can be applied. The salt and water balance should be restored and the obstruction released or side-tracked as may seem expedient. The operation should be

performed as quickly as is consistent with good surgery. The obstructed loops should be handled as little as possible. There is good evidence that this is a dangerous procedure. For this reason it is safer to seek out the collapsed loops and trace them upwards toward the obstruction rather than working from the obstructed loops downwards as is usually taught. When once the distention has been relieved in the involved bowel we think that surgery has accomplished all that is possible. The rest of the treatment is supportive with the hope that too great a toxæmia has not already been established. We do not fear absorption of the retained bowel secretions when the tension has been released. We think that stripping the bowel is

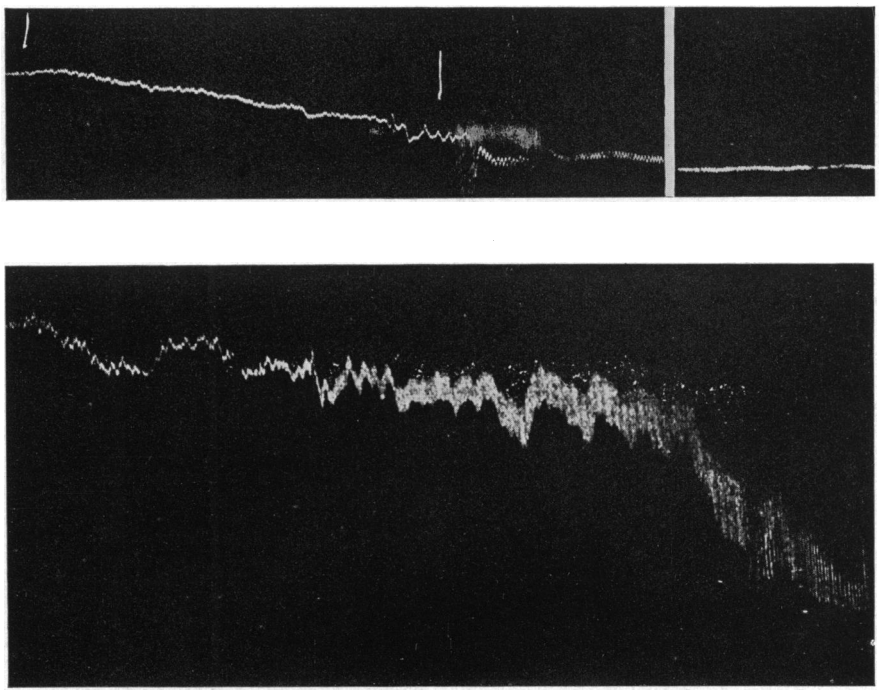

FIG. 1.—When the contents of the obstructed bowel are emptied by "stripping" the bowel between the fingers, there is a marked fall in blood-pressure in experimental animals. (Illustration reproduced from Läwen's article. Zentralbl. f. Chir., vol. liv, p. 1037, 1927.)

a very dangerous procedure and have evidence that it acts the same in human cases as it does in animals. (Fig. 1.)

No. 27,172. H. D., aged thirty-eight years, was admitted to the Strong Memorial Hospital, August 17, 1929, following an automobile accident in which he received an injury to the head. He struck his abdomen on the steering wheel. On admission the only finding was a laceration of the scalp. The day following, there was soreness of the neck and abdominal muscles and he felt quite ill. Two days after the accident, he complained of having a few cramps in the upper abdomen and of distention. He was relieved by an enema. Distention and cramps became worse and he had difficulty in voiding.

Examination showed generalized abdominal tenderness, not very severe; also moderate distention with no evidence of shifting dullness. There had been two normal bowel movements on this day. The white blood count was 15,000. It was decided to

explore the abdomen, because his pulse was gradually rising. Exploration was done on August 20. Turbid fluid was found in the abdomen. The bowel was greatly distended. In the right lower quadrant, there was a mass which turned out to be strangulated terminal ileum, the bowel having passed through a small tear in the mesentery. The appendix, which was caught in this strangulation, was gangrenous. The appendix was removed. A tube was placed in the intestine and the dilated bowel was emptied of its contents. The patient was greatly shocked by this procedure. His blood-pressure

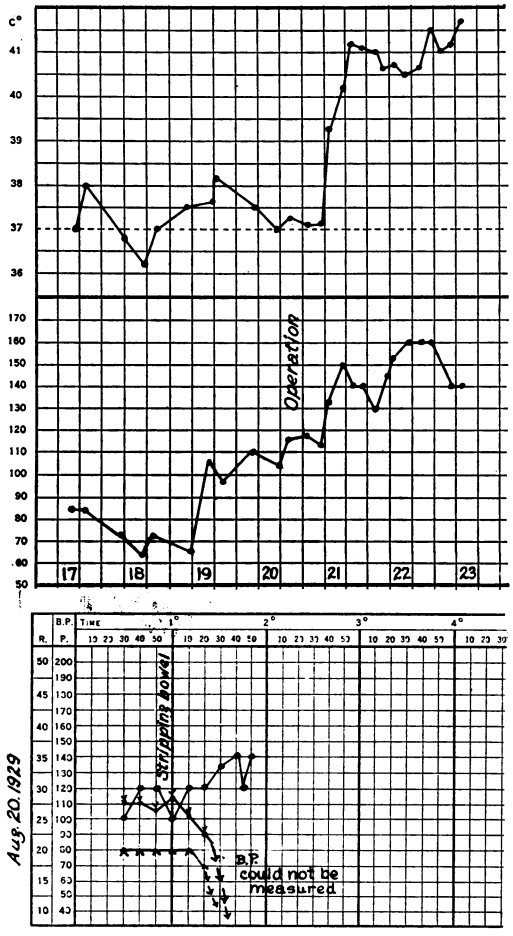

FIG. 2.—The same effect is noted in the human subject when the bowel is similarly "stripped."

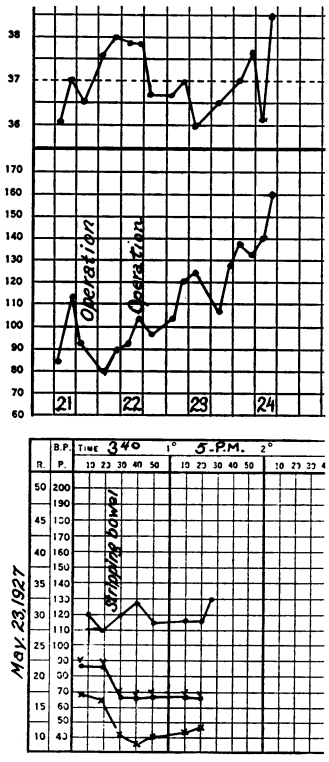

FIG. 3.—A second instance of the same reaction.

dropped until it could no longer be obtained. Following stimulation and intravenous treatment, by the next morning he had revived somewhat. His temperature rose steadily, and also the pulse rate. Saline was administered in large quantities but blood chlorides dropped to 400. The blood non-protein nitrogen rose to 68 the day following operation and the blood-pressure remained low. In spite of the fact that he was given 5,000 cubic centimetres saline daily, the blood chlorides dropped to 316 and the blood non-protein nitrogen rose to 117. On August 23, he became comatose and died. (Fig. 2.)

No. 7150, J. C., a sixty-one-year-old man, was admitted to the Strong Memorial Hospital, May 21, 1927. He complained of distention and vomiting of four days' duration.

The patient had a right inguinal hernia which came down four days before admission and could not be replaced. There was very severe pain about one and a half days later and the hernia had to be reduced about that time. The pain disappeared but vomiting persisted and became fæcal in type. He appeared extremely ill and toxic. His abdomen was distended. There was visible peristalsis. The hernia was not down. The ring was dilated but otherwise there were no positive findings. His blood non-protein nitrogen was 85 and blood chlorides were 395. He was taken to the operating room one hour after admission, having had a saline infusion. An enterostomy was done under local anæsthesia. He was relieved and appeared considerably improved for about twelve hours. The following day he appeared to be worse and his blood non-protein nitrogen was 127 and blood chlorides were 372. A second operation was performed, at which time the obstructed small intestine was opened and the contents emptied through a tube. Although there was marked local improvement in the color and tone of the bowel, the blood-pressure dropped following this procedure and the condition became decidedly more critical. He continued to grow worse and on the day following he died. The final non-protein nitrogen reading was 182. (Fig. 3.)

We believe that simple enterostomy occasionally tides over a crisis until the real problem can be handled, but at best it is only a makeshift operation. In general, the more perfectly an enterostomy functions the worse it is for the patient. When there is a complicating peritonitis present, we are convinced that enterostomy has been a bad operation in our hands. There is resolution quickly in the region of the enterostomy so that the tube does not stay in place long. The opening becomes larger and a fistula develops, which is as bad itself as a high obstruction in that there is no control over the loss of essential secretions. The skin becomes excoriated. Local abscess may develop. In several instances resection with anastomosis has been necessary.

No. 18,198, J. B., a man of forty-two years, was admitted to the Rochester Municipal Hospital, September 20, 1928. He was taken to the operating room, where a ruptured appendix was removed. There was generalized peritonitis present at the time. Following the operation he was very distended, so much so that there was considerable respiratory embarrassment. A duodenal tube was inserted and left in place, but no improvement having occurred in three days an enterostomy was done under local anæsthesia. The blood non-protein nitrogen was 43 and chlorides were 473, with carbon-dioxide combining power of 55 per cent. Twelve days following this a pelvic abscess was drained. During all this time there was distention, which by October became quite severe. At the drainage of the abscess, it was noted that the small bowel was all bound in a mass of adhesions which apparently accounted for the distention. Three weeks following this, the infection having subsided, the small bowel during all this time having drained through an enterostomy, operation was performed for release of adhesions. This was done under gas-oxygen anæsthesia. The patient continued to go downhill, although his bowel now passed material, and it was decided that it was due mainly to the fistula at the old enterostomy site. Through this place the patient lost repeatedly tremendous amounts of fluid which excoriated his whole abdominal wall. Nevertheless, on November 12, 1928, the fistula in the jejunum was resected, and an end-to-end anastomosis was performed. All incisions healed up nicely and he gained both in strength and weight, so that three weeks following closure of the jejunum he was allowed to be up. He was discharged to the surgical Out-Patient Department and warned against eating heavy meals or anything with a large residue. This was carefully explained to the patient and a smooth diet given to him.

Nine days after discharge from the hospital, he took a very heavy meal and was suddenly seized with acute abdominal cramps. He entered the hospital again on Decem-

ber 19, 1928, where it was evident that there was another acute obstruction. The blood non-protein nitrogen was 41.5 and chlorides were 480. At operation two tremendously dilated loops of bowel were found twisted around adhesions at the site of the old enterostomy. The volvulus was untwisted, the adhesions were excised and his recovery was uneventful. On June 26, 1931, he had a repair of a ventral hernia done. He has had no further trouble with intestinal obstruction since the operation in 1928. On November 21, 1931, he reported to the follow-up clinic. There were no complaints.

We now get relief in these cases by an inlying duodenal tube kept in place for gravity drainage for periods of twelve to eighteen hours. And we do not hesitate to attack the real seat of obstruction in the pelvis, even though it be necessary to open an infected area to do it. The collapsed ileal loops are traced down and the adhesions released.

The choice of anæsthesia is very important. The surgeon now has a considerable number of anæsthetics at his disposal. Spinal anæsthesia, nitrous oxide and oxygen supplemented by local anæsthesia, ethylene and local anæsthesia, all have their places and contraindications. Ether and chloroform are to be avoided if possible. The basal anæsthetics, avertin and sodium amytal, when reinforced by nitrous oxide, may also find a place.

We have had seventy-four patients who had obstructions which could be classed in this group. There were thirteen obstructed inguinal hernias with two deaths. One patient died from a *Streptococcus viridans* septicæmia; and the other had a paralytic ileus following reduction of his two-day obstructed hernia by an outside physician. In the hospital he had what we now consider a poor surgical procedure—stripping the bowel of its contents. Five obstructed femoral hernias were released and recovered without incident. In six cases of ventral hernia there were three deaths, a type of hernia which occurs in bad-risk patients even when uncomplicated by obstruction.

One extremely obese woman of seventy-five years had paralytic ileus, following release of her obstruction, necessitating secondary wound closure on the thirteenth day. At autopsy there was an abscess of the left lung, bronchopneumonia, and chronic myocarditis. A sixty-nine-year-old man entered with an obstructed hernia through an old appendix scar. It was sixty hours since the obstruction had occurred and he died in the operating room following a simple release of the obstruction under local anæsthesia. This patient was overwhelmed by his toxæmia and nothing could have saved him. The third fatality occurred in a 225-pound, fifty-three-year-old woman who had an obstructed ventral hernia the size of a football. She had been obstructed for twenty-four hours but refused operation for another twelve hours. She then asked for operation but it was too late to be successful. An internal hernia into the lesser peritoneal sac in a three-day-old baby was freed and the patient made an uninterrupted recovery. In three patients with herniation through tears in the mesentery there were two deaths. One patient entered the hospital eleven days after the onset of his trouble and although the bowel was released and appeared viable, he became worse and died with a general peritonitis.

The second fatality was in a man who had a tear through the mesentery in an accident. The hugely distended bowel was emptied of its contents through a Paul's tube. He never recovered from the shock of this procedure. In the third case a tremendously dilated loop could not be delivered through the rent but the operator performed a lateral anastomosis between the distended and collapsed loops nearest to the torn mesentery. Recovery was uninterrupted. The segment was resected successfully

at a later operation. In one case of obstruction due to the passage of a large gall-stone which had ulcerated through, too much surgery was necessary to complete the operation. The patient was unable to stand it in her precarious condition. Three cases of intussusception were reduced and recovered without complication. One patient with apparent mesenteric thrombosis, whose symptoms indicated an extension upward from a pelvic peritonitis, made a recovery after simple enterostomy. The bowel was a Concord grape color but it must have been viable because it resumed its function after a very precarious convalescence. We cannot account for this recovery and regard it as a miracle. In nineteen patients who had obstruction about old adhesions or bands in the peritoneal cavity, there were four deaths. In one patient, a woman of seventy-four, the condition was critical at entry. She had been obstructed three to four days. The non-protein nitrogen of the blood was 88 and the chlorides 398 at the time of admission. A low enterostomy was done under local anæsthesia but it was of no avail. The second death occurred in a girl of five who was admitted twenty-four hours after her obstruction in rather precarious condition. She did not survive simple release of the obstructing band. There was enormous distention of the small bowel and apparently absorption of toxins had overwhelmed her. In the third case, a surgical error must be held as responsible for the death. This man of fifty-four had a definite band across his terminal ileum which was released. The operator then traced back the bowel to what he supposed was Treitz's ligament. At autopsy this band turned out to be a band obstruction across a high jejunal loop. The bowel above was distended and death had occurred through rupture of a necrotic patch and peritonitis. The fourth fatality was in an eighty-four-year-old woman, with generalized carcinomatosis. The obstructed small bowel had been drained through an enterostomy. The patient's family wisely refused operation for relief of the obstruction with such a hopeless prognosis ahead.

In twenty-one patients with acute peritonitis complicated by obstruction, there were five deaths. Many of these obstructions came on while the patient was convalescing from some acute visceral perforation. In this type of patient diagnosis is difficult, and usually operation is delayed as the surgeon hesitates to reopen the abdomen in the presence of peritonitis.

We have learned to differentiate these patients with obstruction on a dynamic basis from those with paralytic ileus and now no longer hesitate to attack the obstruction at its source. We have practically abandoned enterostomy, which would seem to be the simplest therapy to offer these very ill patients. Two of our fatalities occurred in patients who had enterostomies as their only operation. One of these patients had a subhepatic abscess and bronchopneumonia at autopsy; the other, a girl of three years, had a pelvic abscess. We now look upon this treatment as inadequate and think these patients might possibly have been saved. Our third fatality in this group was in a man of forty-seven, who had a volvulus at operation five days after his original laparotomy. Paralytic ileus followed the untwisting of this segment and an enterostomy did not benefit him. The condition in the fourth patient was so desperate that the repeated efforts to rescue him from the multiple adhesions and fistulas were almost certain to result in failure. In his case the surgeon attempted more surgery than his condition would warrant. An organic obstruction which was not recognized until too late was responsible for the fifth death in this series. The patient had had a perforated gastric ulcer, a streptococcus peritonitis and a pelvic abscess, all of which served to mask the true cause of his symptoms. In the group of

patients with obstruction and peritonitis, there have been some amazing recoveries in what appeared to be almost hopeless conditions. We believe we have made more improvement in the treatment of this group than in any other form of obstruction.

It is very desirable that these patients, who undoubtedly have very irritable small intestines as a result of their peritonitis, be placed on a low-residue smooth diet; and perhaps should take mineral oil for several months. We are confident that a heavy meal with high roughage has brought on acute obstructions in two instances in this series. (Cases 10,581 and 18,198.)

There have been 106 cases in this series with thirty deaths—28.5 per cent. mortality. An analysis of our fatalities indicates that seventeen patients came too late for any therapy—(54 per cent.); six patients died of conditions as complications or accidents beyond the control of the surgeon—(20 per cent.); diabetic coma; streptococcic septicæmia; pneumonia and lung abscess; boric-acid poisoning; refusal of surgery; too many obstructions and complication; seven deaths may be fairly charged against the surgery itself—(23.3 per cent.). In three very ill patients there was too late recognition of a surgical complication which might have been remedied. In one patient there was failure to recognize a second high obstruction. There was a technical error, allowing leakage from a suture line in one instance. And in two cases the operation, enterostomy, may be regarded as insufficient to have relieved the condition. In addition to this, there were probably four errors in judgment in critically ill patients. Two of these errors consisted in too much surgery; and the other two, in the choice of a procedure which is dangerous in itself and fundamentally wrong in principle.

Combined Features of Obstruction and Strangulation Hernias

No. 6030, male, aged fifty-three years. Type of obstruction.—Obstructed inguinal hernia. Time since onset.—Four hours. General condition.—Good. Anæsthesia.—Local. Operation.—Release, repair. Result.—Well.

No. 7946, male, aged three months. Type of obstruction.—Obstructed inguinal hernia. Time since onset.—Six to eight hours. General condition.—Good. Anæsthesia.—Drop ether. Operation.—Release, repair. Result.—Well.

No. 24,902, male, aged seventy-two years. Type of obstruction.—Obstructed inguinal hernia. Time since onset.—Five hours. General condition.—Fair. Anæsthesia.—Local. Operation.—Release, repair. Result.—Well.

No. 28,280, male, aged thirty-nine years. Type of obstruction.—Obstructed inguinal hernia. Time since onset.—Ten hours +. General condition.—Good. Anæsthesia.—Gas and oxygen. Operation.—Release, repair. Result.—Well.

No. 28,940, male, aged eighty-one years. Type of obstruction.—Obstructed inguinal hernia. Time since onset.—Eight to ten hours. General condition.—Fair. Anæsthesia.—Spinal. Operation.—Release, repair. Result.—Well.

No. 35,973, male, aged forty-two years. Type of obstruction.—Obstructed inguinal hernia. Time since onset.—Four hours. General condition.—Good. Anæsthesia.—Spinal. Operation.—Release, repair. Result.—Well.

No. 36,553, male, aged fifty-nine years. Type of obstruction.—Obstructed inguinal hernia. Time since onset.—Three and a half hours. General condition.—Cancer, stomach. Anæsthesia.—Local. Operation.—Release, repair. Result.—Well.

No. 40,976, female, aged fifty-seven years. Type of obstruction.—Obstructed inguinal hernia. Time since onset.—Six hours. General condition.—Obese, good. Anæsthesia.—Spinal. Operation.—Release, repair. Result.—Well.

No. 43,510, male, aged eighty-three years. Type of obstructon.—Obstructed inguinal hernia. Time since onset.—Three hours. General condition.—Arteriosclerosis, hypertension. Anæsthesia.—Local. Operation.—Release, repair. Result.—Well.

No. 50,465, male, aged eighty-seven years. Type of obstruction.—Obstructed inguinal hernia. Time since onset.—Five and a half hours. General condition.—Good. Anæsthesia.—Local. Operation.—Release, repair. Result.—Well.

No. 51,923, male, aged seventy-eight years. Type of obstruction.—Obstructed inguinal hernia. Time since onset.—One and a half hours. General condition.—Good. Anæsthesia.—Local. Operation.—Release, repair. Result.—Well.

No. 7150, male, aged sixty-one years. Type of obstruction.—Obstructed inguinal hernia. Time since onset.—Four days. General condition.—Bad, non-protein nitrogen, 123.5. Anæsthesia.—1, Local; 2, local. Operation.—Enterostomy; lateral anastomosis. Result.—Died. Remarks.—Contents stripped through tube.

No. 44,697, male, aged two months. Type of obstruction.—Obstructed inguinal hernia. General condition.—Bad. Anæsthesia.—Drop ether. Operation.—Release, repair. Result.—Died. Remarks.—One week post-operative died, streptococcus viridans septicæmia.

No. 12,088, female, aged fifty-two years. Type of obstruction.—Obstructed femoral hernia. Time since onset.—Five hours. General condition.—Obese; blood-pressure, 200/100. Anæsthesia.—Local, ether. Operation.—Release, repair. Result.—Well.

No. 21,528, male, aged seventy-eight years. Type of obstruction.—Obstructed femoral hernia. Time since onset.—Two days. General condition.—Bad, non-protein nitrogen, 100. Anæsthesia.—Scopolamine; morphine, local. Operation.—Release, repair. Result.—Well.

No. 23,162, female, aged fifty-two years. Type of obstruction.—Obstructed femoral hernia. Time since onset.—Fourteen hours. General condition.—Fair. Anæsthesia.—Local, gas and oxygen. Operation.—Release, repair. Result.—Well.

No. 33,491, female, aged sixty-three years. Type of obstruction.—Obstructed femoral hernia. Time since onset.—Seven hours. General condition.—Chronic nephritis, hypertension. Anæsthesia.—Local. Operation.—Release, repair. Result.—Well.

No. 43,507, male, aged forty-seven years. Type of obstruction.—Obstructed femoral hernia. Time since onset.—Six hours. General condition.—Diabetes. Anæsthesia.—Local, gas and oxygen. Operation.—Release, repair. Result.—Well.

No. 30,090, male, aged forty-two years. Type of obstruction.—Obstructed ventral hernia. Time since onset.—Six hours. General condition.—Good. Anæsthesia.—Gas and oxygen. Operation.—Release, repair. Result.—Well.

No. 33,213, male, aged forty-six years. Type of obstruction.—Obstructed ventral hernia. Time since onset.—Several hours. General condition.—Good. Anæsthesia.—Local. Operation.—Release, repair. Result.—Well.

No. 54,383, female, aged sixty-one years. Type of obstruction.—Obstructed ventral hernia. Time since onset.—Twenty-four hours. General condition.—Good. Anæsthesia.—Local. Operation.—Release, repair. Result.—Well.

No. 1145, male, aged sixty-nine years. Type of obstruction.—Obstructed inguinal hernia. Time since onset.—Sixty hours. General condition.—Desperate. Anæsthesia.—Local. Operation.—Release, repair. Result.—Died. Remarks.—No chance; too late.

No. 24,620, female, aged fifty-three years. Type of obstruction.—Obstructed ventral hernia. Time since onset.—Twenty-four hours + twelve hours. Refused operation. General condition.—Weight, 225 pounds. Very poor. Anæsthesia.—Ether. Operation.—Release, repair. Result.—Died. Remarks.—Patient waited too long. Hernia size of football.

No. 37,846, female, aged seventy-five years. Type of obstruction.—Obstructed

ventral hernia. Time since onset.—Five hours. General condition.—Extreme obesity. Anæsthesia.—Gas and oxygen, ether. Operation.—Release, repair. Result.—Died. Remarks.—Paralytic ileus; bursting wound; secondary closure; bronchopneumonia; lung abscess; chronic myocarditis.

No. 35,271, male, aged three days. Type of obstruction.—Internal hernia into lesser peritoneal sac. Time since onset.—Three days. General condition.—Fair, non-protein nitrogen, 74. Anæsthesia.—Drop ether. Operation.—Release. Result.—Well. Remarks.—Unusual case; recovered nicely.

Old Adhesions

No. 14,258, male, aged twenty-six years. Type of obstruction.—Old adhesions, appendix, post-operative. Time since onset.—Seven and a half hours. General condition. —Good. Anæsthesia.—Gas and oxygen. Operation.—Release two places. Result.—Well. Remarks.—Nine months after appendix operation.

No. 18,198, male, aged forty-two years. Type of obstruction.—Old pelvic adhesions; volvulus. Time since onset.—Five to six hours. General condition.—Good. Anæsthesia. —Gas and oxygen, ether. Operation.—Release. Result.—Well. Remarks.—Followed heavy meal; non-protein nitrogen, 41.5.

No. 22,507, female, aged sixty-three years. Type of obstruction.—Old band adhesions. Time since onset.—Three days. General condition.—Fair. Anæsthesia.—Gas and oxygen, ether. Operation.—Release, enterostomy. Result.—Well.

No. 22,508, male, aged thirty-nine years. Type of obstruction.—Old adhesions; several obstructions. Time since onset.—Two hours. General condition.—Fair. Anæsthesia.—Spinal. Operation.—Release several bands. Result.—Well. Remarks.—Eight months after acute peritonitis.

No. 24,529, male, aged forty-seven years. Type of obstruction.—Old adhesions previous gall-bladder operation. Time since onset.—Fourteen hours. General condition.— Good. Anæsthesia.—Gas and oxygen, ether. Operation.—Release. Result.—Well.

No. 25,589, male, aged twenty-nine years. Type of obstruction.—Old adhesions operative scar. Time since onset.—Forty-eight hours. General condition.—Fair. Anæsthesia. —Gas and oxygen. Operation.—Release. Result.—Well.

No. 26,978, female, aged forty-five years. Type of obstruction.—Old adhesions previous appendicitis. Time since onset.—Thirty hours. General condition.—Good. Anæsthesia.—Gas and oxygen, ether. Operation.—Release. Result.—Well.

No. 26,978, female, aged forty-six years. Type of obstruction.—Old adhesions, previous appendicitis. Time since onset.—Eighteen hours. General condition.—Good. Anæsthesia.—Spinal. Operation.—Release several bands. Result.—Well. Remarks.— Six months after previous entry.

No. 30,304, male, aged forty-eight years. Type of obstruction.—Metastatic cancer, adhesions pelvis. Time since onset.—Gradual, partial; two to three days, complete. General condition.—Fair. Anæsthesia.—Spinal. Operation.—Ileocolostomy. Result.—Well. Remarks.—Enormous loops; ileum bound firmly in carcinoma.

No. 31,698, female, aged twenty-one years. Type of obstruction.—Old adhesions, previous appendicitis. Time since onset.—Fifteen hours. General condition.—Good. Anæsthesia.—Spinal. Operation.—Release. Result.—Well.

No. 32,610, male, aged five years. Type of obstruction.—Old adhesions about old enterostomy. Time since onset.—Twelve hours. General condition.—Good. Anæsthesia. —Gas and oxygen, drop ether. Operation.—Release. Result.—Well. Remarks.—Old enterostomy opened, repaired.

No. 35,613, male, aged thirty-eight years. Type of obstruction.—Old adhesions about colon. Time since onset.—Several days. General condition.—Poor; non-protein nitrogen, 86; chlorides, 295. Anæsthesia.—Ether. Operation.—Release, enterostomy. Result.— Well. Remarks.—Condition critical, non-protein nitrogen to 101 post-operative.

No. 44,368, male, aged sixty years. Type of obstruction.—Adhesions two previous

laparotomies. Time since onset.—Thirteen hours. General condition.—Good. Anæsthesia.—Ether. Operation.—Release band. Result.—Well.

No. 46,975, female, aged fifteen months. Type of obstruction.—Adhesions cong. or inflam. Time since onset.—Five days. General condition.—Critical, pulse 180. Anæsthesia.—Drop ether. Operation.—Release bands. Result.—Well.

No. 50,809, female, aged seventy-six years. Type of obstruction.—Old bands. Time since onset.—Twenty-four hours. General condition.—Very poor; hypertensive heart disease.—Anæsthesia.—Local, drop ether. Operation.—Release bands. Result.—Well. Remarks.—Non-protein nitrogen, 47.

No. 2710, female, aged seventy-four years. Type of obstruction.—Old pelvic adhesions. Time since onset.—Three to four days. General condition.—Critical. Anæsthesia.—Local. Operation.—Enterostomy (low). Result.—Died. Remarks.—Non-protein nitrogen, 88–115; chlorides, 398–450.

No. 3292, female, aged eighty-four years. Type of obstruction.—Old adhesions known cancer metastases. Time since onset.—Forty-eight hours. General condition.—Critical. Anæsthesia.—Local. Operation.—Enterostomy. Result.—Died. Remarks.—Non-protein nitrogen, 58; lived twelve days. Family opposed to further operation.

No. 24,919, female, aged five years. Type of obstruction.—Old pelvic adhesions. Time since onset.—Twenty-four hours. General condition.—Very sick, pulse 180. Anæsthesia.—Drop ether. Operation.—Release. Result.—Died. Remarks.—Tremendous distention small bowel.

No. 28,967, male, aged fifty-four years. Type of obstruction.—Old adhesions. Time since onset.—Gradual, partial; one to two days, complete. General condition.—Bad, hemiplegia, recent. Anæsthesia.—Ether. Operation.—Release bands at ileum. Result.—Died. Remarks.—Bands about jejunum, mistaken for Treitz's ligament.

Fresh Adhesions with Peritonitis

No. 7116, female, aged nineteen years. Type of obstruction.—Pelvic peritonitis adhesions. Time since onset.—Gradual, complete one day. General condition.—Good. Anæsthesia.—Gas and oxygen, ether. Operation.—Release, enterostomy. Result.—Well.

No. 10,581, male, aged sixteen years. Type of obstruction.—Adhesions, ruptured appendix, peritonitis. Time since onset.—Gradual; two to three days complete. General condition.—Poor. Anæsthesia.—Gas and oxygen, local. Operation.—Release enterostomy. Result.—Well. Remarks.—Desperate type of case, appendicitis; four days post-operative enterostomy; one month post-operative, drainage pelvic abscess; two days later enterostomy; one month later release adhesions; enterostomy.

No. 13,872, male, aged forty years.—Type of obstruction.—Adhesions, ruptured appendix, peritonitis. Time since onset.—Gradual, one to two days complete. General condition.—Fair. Anæsthesia.—Gas and oxygen. Operation.—Jejunostomy; release. Result.—Well. Remarks.—Resection and anastomosis of jejunostomy necessary later.

No. 18,198, male, aged forty-two years. Type of obstruction.—Adhesions, ruptured appendix, peritonitis. Time since onset.—Thirty-six days post-operative; two to three days complete. General condition.—Fair. Anæsthesia.—Gas and oxygen. Operation.—Release. Result.—Well. Remarks.—Paralytic ileus; enterostomy; release adhesions; resection enterostomy; end-to-end anastomosis.

No. 18,963, male, aged thirty-eight years. Type of obstruction.—Adhesions, ruptured appendix, peritonitis. Time since onset.—Gradual, one day complete. General condition.—Poor. Anæsthesia.—Gas and oxygen. Operation.—Release. Result.—Well. Remarks.—Paralytic ileus; enterostomy; release adhesions; resection enterostomy; end-to-end anastomosis.

No. 22,508, male, aged thirty-nine years. Type of obstruction.—Volvulus about adhesions to laparotomy wound; appendicitis; peritonitis. Time since onset.—One to two days complete. General condition.—Fair. Anæsthesia.—Spinal; local. Operation.—

Release; enterostomy. Result.—Well. Remarks.—Did not improve after release. Enterostomy then done.

No. 32,610, male, aged five years. Type of obstruction.—Adhesions, ruptured appendix, peritonitis. Time since onset.—Gradual; ten days post-operative. General condition.—Fair. Anæsthesia.—Spinal. Operation.—Release; enterostomy. Result.—Well. Remarks.—Enterostomy persisted as fæcal fistula for long time. Then closed spontaneously.

No. 39,065, female, aged forty-four years. Type of obstruction.—Adhesions, ruptured appendix, peritonitis. Time since onset.—Gradual, eighty-four days post-operative; one to two days complete. General condition.—Fair. Anæsthesia.—Gas and oxygen. Operation.—Release; enterostomy. Result.—Well.

No. 39,823, male, aged twenty-two years. Type of obstruction.—Adhesions, ruptured appendix, peritonitis. Time since onset.—Gradual, ten days post-operative, one day complete. General condition.—Poor. Anæsthesia.—Local, gas and oxygen. Operation.—Enterostomy; release. Result.—Well. Remarks.—Two enterostomies; release adhesions; resection; enterostomy; end-to-end anastomosis; subphrenic abscess.

No. 41,539, male, aged forty-six years. Type of obstruction.—Adhesions, ruptured appendix, peritonitis. Time since onset.—Eight days post-operative; one to two days complete. General condition.—Poor. Anæsthesia.—Gas and oxygen; ether. Operation.—Release. Result.—Well. Remarks.—Enormous distention all way to Treitz's ligament.

No. 41,560, male, aged forty-five years. Type of obstruction.—Twist about adhesions to laparotomy wound. Bleeding gastric ulcer; open wound; secondary closure. Time since onset.—Ten days post-operative; three days complete. General condition.—Fair. Anæsthesia.—Avertin; gas and oxygen. Operation.—Release. Result.—Well.

No. 42,274, female, aged forty years. Type of obstruction.—Volvulus about adhesions to laparotomy wound. Acute cholecystitis; peritonitis. Time since onset.—Seven days post-operative; two to three days complete. General condition.—Fair. Anæsthesia.—Gas and oxygen. Operation.—Release. Result.—Well. Remarks.—Confusion with post-operative dilatation of stomach.

No. 43,356, female, aged thirty-five years. Type of obstruction.—Pelvic abscess; appendicitis; peritonitis local. Time since onset.—Seven days post-operative; one to two days complete. General condition.—Good. Anæsthesia.—Gas and oxygen. Operation.—Release. Result.—Well.

No. 52,263, female, aged twenty-five years. Type of obstruction.—Adhesions pelvis, appendicitis; local peritonitis. Time since onset.—Gradual, seven days post-operative; one day complete. General condition.—Good. Anæsthesia.—Spinal. Operation.—Release. Result.—Well.

No. 52,263, female, aged twenty-five years. Type of obstruction.—Volvulus about adhesions laparotomy wound. Time since onset.—Sudden; waited two days. General condition.—Poor. Anæsthesia.—Local, ether. Operation.—Release. Result.—Well. Remarks.—Patient critically ill after volvolus. Diagnosed as pulmonary embolism at first.

No. 52,596, male, aged seven years. Type of obstruction.—Adhesions, appendicitis; peritonitis. Time since onset.—Gradual, six days post-operative; one day complete. General condition.—Fair. Anæsthesia.—Drop ether. Operation.—Release. Result.—Well. Remarks.—Fæcal fistula cæcum; spontaneous closure.

No. 34,716, male, aged forty-four years. Type of obstruction.—Adhesions, appendicitis; peritonitis. Time since onset.—Gradual; ten days post-operative; thirty-six hours complete. General condition.—Fair. Anæsthesia.—Spinal, drop ether. Operations.—Two enterostomies. Result.—Died. Remarks.—Subhepatic abscess; bronchopneumonia; unreleased adhesions at post-mortem.

No. 38,789, male, aged forty years. Type of obstruction.—Kink about adhesion, laparotomy wound. Ruptured gastric ulcer; pelvic abscess. Time since onset.—Gradual; ten days to two weeks; two to three days complete. General condition.—Poor. Anæs-

thesia.—Avertin, local. Operation.—Enterostomy. Result.—Died. Remarks.—Hemolytic streptococcus peritonitis; obstruction diagnosed too late.

No. 42,311, male, aged twelve years. Type of obstruction.—Multiple obstructions; adhesions, appendicitis; peritonitis. Time since onset.—Gradual, two and one-half weeks post-operative; complete obstruction one to two days. General condition.—Poor. Anæsthesia.—Gas and oxygen. Operation.—Repeated operations. Result.—Died. Remarks.—Appendectomy; two weeks post-operative, drainage pelvic abscess; eighteen days post-operative, release obstruction; enterostomy; thirty-two days post-operative, release obstruction; thirty-four days post-operative, lateral anastomosis ileum to colon; forty-eight days post-operative, closure ileocolic fistula; fifty-one days post-operative, same; seventy-seven days post-operative, release multiple adhesions pelvis; resection enterostomy; end-to-end anastomosis. Boy almost moribund. Bad case. Too much surgery at close.

No. 45,605, male, aged forty-seven years. Type of obstruction.—Volvolus about adhesions laparotomy wound. Acute cholecystitis; peritonitis. Time since onset.—Gradual; seven days post-operative; complete two days. General condition.—Poor. Anæsthesia.—Gas and oxygen; ether. Operation.—Release. Result.—Died. Remarks.—Paralytic ileus at autopsy.

No. 51,868, female, aged two years, eleven months. Type of obstruction.—Adhesions, appendicitis; peritonitis. Time since onset.—Gradual, fourteen days; one to two days complete. General condition.—Poor. Anæsthesia.—Drop ether. Operation.—Enterostomy only. Result.—Died. Remarks.—Unreleased adhesions at post-mortem.

Miscellaneous

No. 269, male, aged twenty-eight years. Type of obstruction.—Mesenteric thrombosis. Time since onset.—Five days. General condition.—Peritonitis; ruptured appendix. Anæsthesia.—Local, gas and oxygen. Operation.—Enterostomy. Result.—Well. Remarks.—Bowel Concord grape color. Cannot account for recovery.

No. 18,754, male, aged four years. Type of obstruction.—Intussusception.—Time since onset.—Eight hours. General condition.—Fair. Anæsthesia.—Gas and oxygen. Operation.—Reduction. Result.—Well.

No. 25,964, male, aged seven months. Type of obstruction.—Intussusception. Time since onset.—Eight hours, possibly thirty-two. General condition.—Poor. Anæsthesia.—Drop ether. Operation.—Reduction; lateral anastomosis. Result.—Well.

No. 27,833, female, aged six months. Type of obstruction.—Intussusception. Time since onset.—Twelve hours. General condition.—Good. Anæsthesia.—Drop ether. Operation.—Reduction. Result.—Well.

No. 3335, male, aged twenty-five years. Type of obstruction.—Through tear in mesentery. Time since onset.—Nine hours. General condition.—Good; non-protein nitrogen, 66. Anæsthesia.—Local, gas and oxygen. Operation.—Lateral anastomosis; enterostomy. Result.—Well. Remarks.—Resection involved loop several months later.

No. 23,505, male, aged thirty-three years. Type of obstruction.—Through tear in mesentery. Time since onset.—Eleven days.—General condition.—Poor. Anæsthesia.—Ether. Operation.—Release, enterostomy. Result.—Died. Remarks.—Peritonitis present. Too late for surgery.

No. 27,172, male, aged thirty-eight years. Type of obstruction.—Through tear in mesentery. Time since onset.—Two days. General condition.—Poor. Anæsthesia.—Gas and oxygen; ether. Operation.—Release, stripping of bowel; enterostomy. Result.—Died. Remarks.—Late case. Wisdom of surgery questionable.

No. 44,626, male, aged forty-one years. Type of obstruction.—Complete obstruction at terminal ileum; cancer of cæcum. Time since onset.—Two days. General condition.—Fair; non-protein nitrogen, 46. Anæsthesia.—Ether. Operation.—Ileocolostomy. Result.—Well. Remarks.—Resection cancer ascending colon later.

No. 42,674, female, aged forty-four years. Type of obstruction.—Gall-stone obstruc-

tion. Time since onset.—Five days. General condition.—Poor. Anæsthesia.—Ether. Operation.—Removal of stones; gastroenterostomy. Result.—Died. Remarks.—Late case. Too much surgery.

COMPLETE SERIES

Simple obstruction, seven cases, two deaths, 28.5 per cent.; strangulation complete, twenty-two cases, eleven deaths, 50 per cent.; strangulation partial, two cases, no deaths; combined obstruction and strangulation, seventy-four cases, seventeen deaths, 22.9 per cent. Total, 105 cases, thirty deaths, 28.5 per cent.

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