surgeon under whom he or she is admitted. It is to be regretted that at the present time these rooms are too few, and it is to be hoped that in the near future more may be provided, for such accommodation has valuable advantages to all who can utilise it.

The patients who are admitted into the hospital come from an area covered by a circle which radiates about six miles from the building; some come from far distances for special reasons. The out-patients are largely Battersea and Wandsworth people. General medical cases are neither admitted nor seen as out-patients, nor are any specific contagious or infectious diseases; such patients when they apply are referred either to their own medical men or to some hospital. 276 of these have been passed on during the 10 months of this year.

I have thus, gentlemen, briefly explained to you how this hospital came into being, and how from the wants of the neighbourhood it had in the course of years to yield part of its original constitution and to become practically a free hospital for accidents and emergencies. All its special features are worthy of your strongest support, for all are sound in principle and in this hospital have been proved sound in practice. In opening this "Victoria Wing" for out-patient work I must congratulate you upon doing so under the pleasant feeling that you have almost enough funds in hand to pay for it and to equip it. That it will be most beneficial for the work of the hospital I can vouch, for I know what good work has been done under the difficult circumstances which Mr. Lyster and his able helps have had to contend against, and with such arrangements as have been provided for the future the work must even be improved. But I must remind you that what has been done is but a promise of what in the near future has to be done, and that is the completion of the plan which has been laid before you. Until that is completed by no means rest on your oars, but pull on with all your force. The employers of labour in Battersea have through their influence upon the governors of the old hospital, where such good work was done, forced them as it were, by the weight of argument, the logic of facts, and the persistent expression of the wants of their people, to turn the hospital into a free one, with all its risks and responsibilities. The workers at the hospital are quite prepared to undertake all its professional and nursing responsibilities, and, indeed, to accept all risks, except one, and that is its financial responsibilities; these we must throw entirely upon the shoulders of the leaders of labour who by their action have brought about this change and the friends with whom they have influence. In saying this I will express my belief that we shall not do this in vain, for the interest which is taken by these leaders of labour, the tradesmen of the neighbourhood, the artisans and the gentry of the district, is so sound and earnest that we do not doubt, now that the hospital is established upon a free basis, that all will pull together with one object, and that is to get together a fund sufficient for the hospital to pay its way and to build the three wings as soon as possible.

Canon Erskine Clarke, ladies and gentlemen, I now declare this new wing, which is to be called the "Victoria Wing," open from this day—and may God bless the work which is to be done there.

ON DUODENAL ULCER AND ITS SURGICAL TREATMENT.

BY B. G. A. MOYNIHAN, M.S. LOND., F.R.C.S. ENG.,

ASSISTANT SURGEON TO THE LEEDS GENERAL INFIRMARY; CONSULTING SURGEON TO THE SKIPTON AND DISTRICT HOSPITAL AND TO THE MIRFIELD MEMORIAL HOSPITAL.

DUODENAL ULCER.

ULCERATION of the duodenum may be acute or chronic—acute when there is a rapid destruction, tending to perforation, of the wall, and chronic when the symptoms are latent or subdued and the pathological processes which cause them are altogether passive. Possibly the two forms are often expressions of the same disease, the acute ulcer, with a rapidity and completeness of invasion that suggest an infective origin being the earlier stage of a chronic ulcer in which an attempt is made to check and to repair the ruin which has been wrought. Within the last few years duodenal

ulcers have come more closely under the observation of the surgeon. Acute ulcers have led to perforation; chronic ulcers have caused repeated attacks of hæmorrhage or in their healing have so narrowed the bowel that surgical methods alone have been able to afford relief. As our capacity for dealing effectively with any of these complications has increased, so also and concomitantly have our opportunities increased.

Position of the ulcer.—Duodenal ulcers are generally situated in the first portion of the duodenum. Collin found in a series of 262 cases that 242 were placed in the first portion, 14 in the second, three in the third, and three in the fourth. Perry and Shaw found that in 149 cases 123 were situated in the first portion, 16 in the second, two in the third and fourth; in eight cases the ulcers were scattered. Oppenheimer states that in 81 cases 69 were situated in the first part, eight in the second, and four in the third and fourth. Ulcers in the first portion of the duodenum, then, are at least ten times more frequent than in the second. In the majority of cases the ulcers are solitary. If multiple they are usually crowded together in the first portion; but ulcers in the first portion associated with others in the second or third are recorded by Clark, Schwartz, and Dudensing. When two ulcers are present they are not infrequently opposed, those portions of the wall being affected which lie in contact. A similar opposition is, of course, not seldom observed in the stomach. The frequency of such a condition is suggestive of infection. Ulcers in various stages of activity may co-exist. An acute perforating ulcer may be found with a chronic ulcer or either with the scars and puckers of healed ulcers.

Age.—Patients of all ages may be affected. Oppenheimer has collected 15 cases of "melæna neonatorum," resulting from duodenal ulcer. Chvostek found ulcers present in children three hours, four days, and seven weeks old. Ulcer in the new-born child is described by Henoch, Zerschwitz, and Dusser. Krannhals relates the case of a child five years of age who died from dysentery. Ulceration was present in the duodenum; the rest of the small intestine was healthy. Haman records a case of the traumatic rupture of an ulcer in a child of 10 years of age. Clark records cases of perforation in patients 19 years and 20 years of age. Krannhals observed a case in a female 79 years old, and Merkel found an ulcer in the duodenum of an old woman, aged 94 years.

Sex.—All observers are agreed that men are much more frequently affected than women, though they vary in the estimates of their relative susceptibility. Taking the statistics of Collin, Perry and Shaw, Trier, Krauss, Chvostek, and Oppenheimer, all of whom have recorded over 50 cases, we have a total of 645 patients, 508 men and 137 women. We may therefore assess the proportion at four males to one female. The cause of the greater frequency of the affection in men is, with our present knowledge, quite inexplicable. Gastric and duodenal ulcers may be present at the same time. Such an occurrence has been described by Rokitsansky, Finlayson, and Oppenheimer, and is noted in the records of two of the patients upon whom I have operated.

SYMPTOMS.

The symptoms of duodenal ulcer are chiefly characterised by their lack of ostentation. In more than half of the cases where ulceration is found at the necropsy symptoms have never been present. In 151 cases collected by Perry and Shaw in which duodenal ulceration was found post mortem there were 91 in which there were no antecedent symptoms. Every author that I have consulted emphasises the "latency" or the "torpidity" of the disease. Symptoms when present may be of an indifferent type or may resemble closely those aroused by ulcer of the stomach. The co-existence of the two forms of ulceration, gastric and duodenal, would seem from my experience to be more frequent than is generally believed, and the apparent confusion in the symptoms of certain cases may be dependent upon the simultaneous presence of both forms of ulcer. The cardinal symptoms are (1) pain, (2) hæmatemesis, and (3) melæna.

1. *Pain* is generally experienced one hour or more after the taking of food, and is referred to the epigastrium, or the right hypochondrium, or indefinitely to the upper part of the abdomen. It is variable in intensity, and though generally trivial and hardly more than a sense of discomfort or vague uneasiness, it may be acute, persistent, and at times almost intolerable. I am disposed to think that reliance may in general be placed upon the time of onset of pain after food

as indicating the position of an ulcer in the stomach or duodenum, and that, as a rule, the nearer the ulcer to the cardia the more swift is the onset of pain. The researches of Professor Birmingham on the anatomy of the stomach enable one to understand the reasons for this. Unless a duodenal ulcer is associated with a gastric ulcer the pain does not appear for from two to three or four hours. Pains radiating to the right shoulder or to the side and back are occasionally noted. It has been said that the drinking of alcoholic fluids increases or elicits the pain.

2. *Hæmatemesis* is an occasional and rather erratic symptom. Vomiting is observed approximately in one-third of the cases. In Perry and Shaw's series of 60 cases presenting symptoms hæmatemesis was present in 14. The bleeding is rarely severe. The characteristic vomiting of duodenal ulcer comes on about two hours or more after food, and bile is not seldom observed in the ejected matter.

3. *Melæna* is not improbably overlooked in a large number of cases, more especially when the intestinal hæmorrhage has been slight. When the vessel opened is large the bleeding may be copious and may induce faintness and subsequent temporary anæmia (see Case 4 of my list). If a large arterial or venous trunk is opened the hæmorrhage may be overwhelming and lethal. Melæna was observed in nine of Perry and Shaw's 60 cases. Oppenheimer found blood in the stools of exactly half of his patients. The examination of the stools for small quantities of blood is so unusual a research in a general hospital that we must indisputably allow that entorrhagia may often pass unnoticed.

THE COMPLICATIONS OF DUODENAL ULCER.

The following are the chief complications of duodenal ulcer: (1) profuse hæmorrhage; (2) perforation (acute, sub-acute, and chronic); (3) cicatricial contraction and induration and their sequelæ; (4) periduodenitis; and (5) cancer. In 20 fatal cases collected by Perry and Shaw nine patients died from hæmorrhage, eight from perforation, and three from cicatricial contraction of the duodenum or bile-duct.

1. *Hæmorrhage* is seen more frequently and in larger quantity in chronic ulcer. The vessels affected may be those in the wall of the bowel or any of the larger arteries or veins in the neighbourhood. Ulceration into the following arteries has been recorded: aorta (Stich, Grunfeld), hepatic (Broussais), gastro-duodenal (Leeds Museum), superior pancreatico-duodenal (Allchin, Wunderlich), and the pyloric, pancreatica magna, gastro-epiploica dextra, and into the vena porta (Rayer and Habershon) and the superior mesenteric vein (Warfvinge).

2. *Perforation*.—A duodenal ulcer may perforate at once and acutely into the peritoneal cavity or may slowly destroy all the coats of the bowel and lead to the formation of a localised encysted abscess. If the former, the fluid escaping from the viscus is free to run at large in the peritoneal cavity. In many of the cases, as is seen from a study of the records and was exemplified in Case 2 recorded below, a well-defined path is taken. The fluid (generally mucus more or less tinged with bile) escapes on to the upper surface of the transverse mesocolon to the right of the hillock which is formed by the fitting in of the transverse colon to the greater curvature of the stomach (see Figure).

Diagram to illustrate the obliquity of the transverse mesocolon on the right side. Fluids escaping from the first portion, or the upper half of the second portion, of the duodenum gravitate to the right kidney pouch and thence to the right iliac fossa.

It therefore tends to run to the right to the hepatic flexure, and then to descend along the outer side of the ascending colon to the iliac fossa. There collecting it may cause symptoms strongly suggestive of appendicitis.

From the iliac fossa the fluid drains to the pelvis, and filling that overflows into the left iliac fossa. If an abscess forms it may be bounded by lymph, by the liver, or by intestines. Meunier describes a local abscess in his case as being bounded by the quadrate lobe of the liver, the gall-bladder, and the transverse mesocolon. Lennander relates a case where an abscess was hemmed in on all sides by intestine. The perforation of such an abscess may lead to acute septic generalised peritonitis as recorded by Planchard. Perforation of the upper portion of the duodenum may lead to subphrenic abscess. Seven cases of this kind are related in Maydl's monograph. An ulcer may destroy all the coats of the bowel and its base be formed by the liver (Keyl, Herzfelder, Collin), or by the gall-bladder (Krauss, Moynihan). An ulcer may destroy all the coats of the bowel and perforate a hollow viscus forming an "internal duodenal fistula." Rokitsky describes a case of gastro-duodenal fistula, Hoffman and Gross cases of cholecysto-duodenal fistula, Murchison, West, and Sanderson cases of duodeno-colic fistula, and Dudensing a case where the ulcer had perforated the pancreatic duct. An ulcer may destroy all the coats and lead to the formation of an abscess which bursts upon the surface of the body, forming an "external duodenal fistula," as recorded by Lumeau and Bucquoy. The duodenal wall may be ulcerated through by an abscess arising from without, as in a case of lumbar abscess bursting into the duodenum close to the biliary papilla, under the care of Davies-Colley.¹

3. *Cicatricial contraction and induration and their sequelæ*.—All ulcers of the duodenum in their healing tend naturally to contract. The results of such contraction will necessarily depend upon the position of the ulcer. If the ulcer has been in the first portion the narrowing of the lumen will result, as in pyloric stenosis, in dilatation of the stomach; if in the second portion there may be a dilatation of the duodenum and the stomach; or if the ulcer has invaded the bile-papilla a narrowing or obliteration of the common bile-duct and pancreatic duct. Four examples of this are quoted by Perry and Shaw, and a case is related by Swensson² in which cholecystenterostomy was performed. If the ulcer is in the third or fourth portions a dilatation of the duodenum and the stomach may result (Rewidzow). The contraction of the inflammatory material in and around an ulcer may affect the structures in the immediate neighbourhood. Collin describes a case of thrombosis and cicatricial ligature of the vena porta caused in this manner.

4. *Periduodenitis* may originate in the localised peritonitis at the base of a duodenal ulcer, from chronic perforation of an ulcer, or from causes primarily unconnected with the duodenum. Of the latter the most common is dependent upon disease of the gall-bladder or bile-ducts. Chronic pancreatitis or malignant disease of the head of the pancreas, following long-continued gall-stone irritation, may also cause the pouring out of inflammatory products by the peritoneum.

5. *Cancer*.—The cancerous transformation in chronic ulcers of the stomach is now a well-recognised pathological change. A similar condition of "ulcus carcinomatosum" has been observed in connexion with chronic duodenal ulcer. Cases are related by Ewald, Schrötter, and Mackenzie. Five cases are quoted by Perry and Shaw, but in no case is the description convincing and I should be disposed to question their claim to acceptance.

THE SYMPTOMS OF ACUTE PERFORATION.

The symptoms of an acute perforation differ at the first but little, if at all, from those which follow the perforation of a gastric ulcer. There is the same sudden, intolerable, and overwhelming pain; there are rigidity and tenderness of the abdomen and profound collapse. In duodenal ulcer there is said to be a disposition to localise the pain in the right hypochondrium rather than in the epigastrium, but the records of published cases, and of my own cases, do not support this. As in gastric ulcer, so in duodenal, the sudden, terrible pain may induce a collapse which proves almost immediately fatal. A few years ago I performed a post-mortem examination for the coroner on a young man who had died suddenly. I found a perforation of the duodenum just beyond the pylorus. The relatives, when pointedly asked, affirmed that the patient had never suffered from any gastric or intestinal disorder.

After the first shock has passed the symptoms and signs

¹ Guy's Hospital Reports, 1893, p. 573.

² Hygeia, Stockholm, 1888.

of gastric and duodenal perforation differ in their development. When the ulcer is in the stomach the signs are those of general peritoneal inflammation; when the ulcer is duodenal the course taken by extravasated fluids leads to a more acute and an earlier involvement of the peritoneum on the right side and in the right iliac fossa. The clinical picture of appendicitis is copied with such accuracy that in the 49 recorded cases tabulated in my list, in 18 the first incision was made over the appendix, after a diagnosis of acute appendicitis had been made. In the final stage the peritoneal infection is universal.

TREATMENT.

The medical treatment of duodenal ulcer should be carried out with the same persistence and care as are needed in treating ulcers of the stomach. Surgical treatment may be called for: (1) when an acute ulcer perforates; (2) when subacute or chronic perforation leads to periduodenal or subphrenic abscesses; (3) in chronic ulcer when pain and gastrorrhagia, or enterorrhagia are persistent and disabling; and (4) when cicatricial contraction and induration or periduodenitis have caused narrowing of the calibre of the gut and dilatation of the stomach or of the stomach and that part of the duodenum behind the stricture.

1. *When an acute ulcer perforates.*—There are on record 49 cases of operation for acute perforation of a duodenal ulcer. I have operated upon two cases, making a total of 51. In 18 of these cases a diagnosis of appendicitis was made; in two cases only, that recorded by Perkins and Wallace and in my first case, was a correct diagnosis achieved. The following are the notes of my two cases:—

CASE 1.—The patient, a male, aged 44 years, was admitted under my care into the Leeds Infirmary on April 24th, 1900, and was sent by Mr. H. de P. Veale of Drighlington. The patient was a morose individual of deficient intelligence, and a history was therefore difficult to elicit. Symptoms had been present for 18 months; the chief of them was pain, experienced after food, two, three, or four hours after, beginning in the right hypochondrium and spreading upwards and downwards. Blood had been observed when the patient vomited; vomiting was frequent but irregular, occurring sometimes within half an hour of a meal, sometimes four hours after. There was no melæna. The patient was kept under observation until May 25th. His pain was evidently most severe and directly influenced by the taking of food. A diagnosis of duodenal ulcer which had been made by Mr. Veale was confirmed and gastro-enterostomy was advised. On the 25th the man became suddenly worse. Pain was complained of over the whole abdomen which was tight, and the abdominal muscles barely moved with respiration. The pulse was 128, the respirations were 28, and collapse was pronounced. Clearly a perforation had taken place. The abdomen was opened and a duodenal ulcer with a perforation about three-quarters of an inch in diameter was found at the beginning of the second portion of the gut. There was commencing peritonitis. The stitches which were introduced to close the ulcer held very imperfectly. After stitching the gut seemed narrowed to at least half its diameter. A gastro-enterostomy was therefore done, a Murphy button being used. The abdomen was cleansed by sponging and a tube with gauze was passed down to the ulcer. The patient never rallied from his collapse and died on May 26th.

CASE 2.—The patient, a male, aged 25 years, was admitted into the Leeds Infirmary on June 18th, 1901, under the care of Mr. W. H. Brown, who kindly gave me charge of the case. The patient, a sturdy, robust labourer, stated that for about four weeks before admission he had experienced pain after food and had vomited. The pain came on either immediately after the taking of food or about from three to four hours subsequently. Vomiting occurred almost immediately after the end of a meal. At 5 P.M. on June 18th, while climbing a ladder, he felt a sudden acute pain in the upper part of the abdomen in the middle line. He reached the top of the ladder, deposited his load, and descended. On reaching the ground he fell and doubled himself up in agony. He was seen by Dr. L. A. Rowden of Roundhay, who sent him at once in his carriage to the infirmary. On admission the patient was profoundly collapsed. The abdomen was exquisitely tender and the muscles formed so rigid a protecting splint that nothing could be felt. Liver dulness was present. There were persistent efforts at vomiting, but little was brought up except frothy mucus. The pulse was 128; the skin was cold. The patient was in the

extremity of anguish. In answer to questions he could utter barely two or three words at each expiratory gasp. Clearly a catastrophe had occurred, and our tentative diagnosis was one of perforated gastric ulcer. I opened the abdomen at 9.50 P.M. (three hours and 50 minutes after perforation). On cutting through the peritoneum a few bubbles of odourless gas and froth escaped. A thin slightly turbid yellowish fluid welled up into the wound. The stomach was examined and found to be intact. A perforation was found equal to a No. 8 or No. 9 catheter in diameter on the anterior wall of the duodenum about one inch from the pylorus. From the opening a yellowish, thick, glairy, bile-stained fluid escaped. The opening was rapidly stitched up by a single continuous suture applied vertically from above downwards and then returning from below upwards. The stitch held quite readily. The abdomen was flushed out thoroughly. The right kidney pouch, the right iliac fossa, and the pelvis contained a turbid yellowish fluid. The left kidney pouch and the left iliac fossa were clean. A drainage tube was placed in the pelvis. A most curious sensation was experienced in handling the omentum and intestines, which, as I remarked at the time, suggested that the intestines had been oiled. The return of the omentum and some small intestine which escaped during the flushing was thereby rendered unusually difficult. During the operation the patient lay on a heated table, was swathed in wool and flannel bandages, and had one-tenth of a grain of strychnine administered hypodermically twice. His condition after the operation was satisfactory. One-twentieth of a grain of strychnine was given hypodermically every four hours for three days. No fluid was allowed by the mouth for 24 hours, sips of water and soda-water being then given. Rectal injections of saline solution (10 ounces) were given every six hours. The drainage-tube was removed in 36 hours. Both wounds healed well and on the nineteenth day the patient sat up. His recovery was quite uneventful.

The accompanying table (Table I.) shows all the cases of acute perforation which have been operated upon up to July, 1901.

In carrying out an operation for a perforated duodenal ulcer the utmost speed consistent with safety and thoroughness is desirable. The abdomen is opened through the right rectus muscle about half an inch or one inch from the median line. Odourless gas escapes as soon as the peritoneum is cut. The perforation, if on the anterior surface, is readily seen, and from the opening bubbles of froth, bile-stained mucus, or altered food will issue. If on the lateral surface the exact position of the ulcer may be discovered by compressing the stomach or duodenum so as to force some of their contents through the rupture. As in the stomach, two ulcers may be found to have perforated, as is recorded by Biggs. As soon as the ulcer is exposed the perforation should be closed by a single or double continuous Lembert suture of silk or fine Pagenstecher thread. The excision of the ulcer is unnecessary and is harmful in so far as it wastes moments which are precious. The rupture being securely closed the peritoneal cavity is cleansed. This should be done freely and methodically. A glass drainage-tube should be introduced into the pelvis by a separate incision above the pubes, and the flushing is then begun. The immediate neighbourhood of the duodenum is first flushed, then, in order, the space between the liver and diaphragm on both sides of the suspensory ligament, the interval between the liver and the transverse colon, the right kidney pouch, the right iliac fossa, the pelvis, the left kidney pouch, and left iliac fossa. The cleansing is best effected by using a long indiarubber tube with a runnel, the soft tubing being readily passed to any spot desired. Saline solution at a temperature (taken with the thermometer) of 105° F. is used. When the returning fluid from all areas is clear the wound may be closed. There is no need to empty by sponging the peritoneal recesses. The usual routine as to the administration of strychnine in large doses hypodermically, the use of a heated table, warm clothing, &c., should be rigidly observed. The value of large doses of strychnine in anticipating and preventing shock does not seem to be appreciated. In a recent case of double primary amputation on the right side at the hip-joint, and on the left in the middle of the thigh, I gave 45 minims of liquor strychninæ hypodermically in the three-quarters of an hour that the patient was on the operating table. The patient recovered, and neither he nor any other patient to whom I have administered Gargantuan doses

TABLE I.—OPERATIONS FOR ACUTE PERFORATING DUODENAL ULCER.

No. of case.	Recorder.	Sex.	Age (years).	History.	Condition found and nature of operation.	Result.	Remarks.	Reference.
1	Mackenzie (operator, Sidney Jones).	M.	35	Indefinite epigastric pain, one week; sudden acute pain; vomiting and collapse; alcoholic.	General peritonitis (cause doubtful). Operation at the end of the second day.	Died in a few hours.	Duodenal ulcer found at necropsy just beyond the pylorus.	THE LANCET, Dec. 1st, 1888, p. 1060.
2	Mackenzie (operator, John Croft).	M.	31	Acute attack resembling intestinal obstruction diagnosed as appendicitis and general peritonitis.	General peritonitis of doubtful origin. Operation on the third day.	Died in a few hours.	Duodenal ulcer found at necropsy immediately beyond the pylorus.	THE LANCET, Dec. 1st, 1888, p. 1060.
3	Boiffin.	M.	29	Sudden seizure; abdominal pain, vomiting, and distension; diagnosis of perforative peritonitis.	General peritonitis. Operation in 90 hours. A cavity containing two quarts of serous fluid was found beneath the liver.	Died on the same day.	—	Congrès Français de Chirurgie, 1892.
4	Lockwood.	M.	28	Sudden, violent pain while drinking tea; later faecal vomiting and tympanites.	Peritonitis; gas and pus evacuated; drainage. Operation in 80 hours.	Died in seven hours.	Perforation of the duodenum found at the necropsy.	Transactions of the Medical Society of London, 1892.
5	Lockwood.	M.	41	Slight previous indigestion. While at work a sudden seizure with abdominal pain and vomiting.	Septic peritonitis; drainage.	Died in ten hours.	Perforation of the duodenum found post mortem.	Transactions of the Medical Society of London, 1892.
6	Pearce Gould.	F.	27	Sudden attack of pain in the right hypochondrium, soon becoming general; vomiting; tympanites; no loss of liver dulness.	General peritonitis; incision below the umbilicus allowed the escape of fluid; then incision above the umbilicus revealed a perforation. Operation in 24 hours; ulcer excised.	Died in six hours.	Suture firm, but general peritonitis.	Middlesex Hospital Reports, 1893.
7	Perry and Shaw (operator, W. H. A. Jacobson).	M.	21	Sudden attack of acute abdominal pain in the lower part; vomiting and collapse.	Large quantity of dark brown acid fluid with faecal odour evacuated.	Died in four hours.	At necropsy a perforation was found in the first part of the duodenum on the anterior surface. A second ulcer was found immediately opposite.	Guy's Hospital Reports, 1893.
8	Lockwood (J. Langton's patient).	M.	56	Brought to hospital with abdomen tympanitic and the signs of acute intestinal obstruction.	Peritonitis; purulent and faecal fluid evacuated.	Died in a few hours.	Ulcer of the duodenum was found at the necropsy; suture could have been easily performed.	THE LANCET, Oct. 27th, 1894, p. 968.
9	Lockwood.	M.	28	Sudden pain in the abdomen while ascending an omnibus; vomiting. Admitted to hospital on seventh day with intestinal obstruction. Coils of intestine were seen to be contracting.	Purulent peritonitis in the pelvis, irrigation, drainage. Operation in 150 hours.	Died in 54 hours.	Ulcer of the duodenum found post mortem, with local peritonitis and abscess. A second ulcer was found in the stomach.	THE LANCET, Oct. 27th, 1894, p. 968.
10	Lockwood.	M.	61	Long history of gastric ulcer; no hæmatemesis; sudden pain in the right hypochondrium; collapse.	Operation in four and a half hours. Perforation was found in the anterior wall of duodenum; this was sutured.	Died in six days.	A second ulcer was found on the posterior wall of the duodenum.	THE LANCET, Oct. 27th, 1894, p. 968.
11	Eve.	M.	28	Sudden abdominal pain while lifting; vomiting immediately; on third day this became faecal.	Operation in 62 hours; sero-pus was evacuated. An ulcer as big as a florin was found one inch from the pylorus; edges pared; omental graft made.	Died in two hours.	No necropsy.	THE LANCET, Nov. 10th, 1894, p. 1092.
12	Dean.	F.	27	Epigastric pain for a fortnight; sudden abdominal pain; vomiting and collapse.	Operation in 30 hours. Incision was made below the umbilicus, then prolonged upwards; gas was seen issuing from near the duodenum. Ulcer was seven inches from the pylorus and was sutured.	Recovered.	Nothing given by the mouth for 17 days. After two months an attack of intestinal obstruction; operation on third day; death.	Transactions of the Medical Society of London, 1894.
13	Brissaud.	M.	35	Sudden abdominal pain and vomiting; tympanites; collapse.	Operation in 51 hours. Incision over the appendix gave issue to faecal matter; general peritonitis; drainage.	Died in a few hours.	Perforation was found just beyond the pylorus.	Collin: Thèse de Paris, 1894.
14	Bryant.	M.	—	After a debauch a sudden attack of pain in the right side of the abdomen.	Operation in 53 hours, as for appendicitis; pus and milky fluid were evacuated; drainage.	Died.	A perforated duodenal ulcer was found at the necropsy. A sac around the cæcum contained milk and food.	Medical Record, 1895.

TABLE I.—OPERATIONS FOR ACUTE PERFORATING DUODENAL ULCER—(Continued).

No. of case.	Recorder.	Sex.	Age (years).	History.	Condition found and nature of operation.	Result.	Remarks.	Reference.
15	Sheild.	M.	20	Sudden severe pain while at the theatre. No vomiting until second day; tympany, pain, and tenderness over cæcum. An opinion was expressed that the case was one of appendicitis.	Operation in 60 hours. Odourless gas; thin pus and lymph in peritoneum. Lavage.	Died in 24 hours.	A perforation was found in the anterior wall of the first portion of the duodenum.	THE LANCET, May 11th, 1895, p. 1169.
16	Sheild.	M.	23	A sudden attack of pain and vomiting three years before. Present attack began with acute pain and vomiting; tympanites.	Operation in 120 hours. Odourless gas and thin pus escaped. The jejunum was incised; lavage; drainage.	Died in 22 hours.	Necropsy revealed a duodenal ulcer half an inch from the pylorus.	THE LANCET, May 11th, 1895, p. 1169.
17	Bolton.	M.	28	The patient was an alcoholic. Sudden abdominal pain and vomiting, followed by tympanites.	General peritonitis. Irrigation; drainage.	Died in three days.	Ulcer in third portion of the duodenum, with pancreas forming the base.	Medical Record, 1900, p. 495.
18	Bolton.	M.	35	The patient was an alcoholic. History of similar attack 13 years before. Abdominal pain and vomiting for a few days; tender abdomen.	Diagnosis of appendicitis. Incision over appendix revealed general peritonitis. Drainage.	Died in a few hours.	Ulcer in first portion; periduodenitis.	Medical Record, 1900, p. 495.
19	Festal.	M.	56	A long history of gastritis, diarrhoea, and melæna. An acute attack of pain four hours after food, vomiting, and collapse. Tumefaction on third day in iliac fossa.	Diagnosis of appendicitis. Operation in 66 hours. Incision over appendix; douche and drainage.	Died in nine hours.	Ulcer just below the pylorus occupying two-thirds of the circumference of the gut. Healed ulcer of the stomach.	Journal de Médecine de Bordeaux, 1895.
20	Herezel.	M.	33	Sudden pain in the right hypochondrium; collapse.	Operation in 25 hours. Purulent fibrinous peritonitis. Perforation found and sutured.	Recovered.	Attack of bronchitis during convalescence.	Pagenstecher: Deutsche Zeitschrift für Chirurgie, 1899, p. 556.
21	Bolton.	M.	35	A hard drinker. Sudden severe abdominal pain without vomiting; diagnosis of appendicitis.	Operation in 20 hours; general peritonitis.	Died in 24 hours.	Necropsy showed a perforating ulcer in the duodenum one and a quarter inches from the pylorus, and a second ulcer lower down.	Medical Record, 1900.
22	Warren.	M.	52	An attack of acute epigastric pain six years previously; ill ever since. Acute attack of severe pain about pylorus, typanites, and vomiting; appendicitis diagnosed.	Operation on fourth day. The intestines were distended and covered with lymph. Ulcer in duodenum was sutured.	Died in three days.	No necropsy.	Boston Medical and Surgical Journal, 1896.
23	Dunn.	M.	—	Sudden epigastric pain while at work followed by vomiting; tympanites and loss of liver dulness.	Operation in 30 hours. Perforation in the anterior wall of the first portion of the duodenum. Gas and yellowish fluid were evacuated. A second laparotomy was necessitated owing to return of symptoms; adhesions only found; mural abscess.	Recovered.	—	Brit. Med. Jour., vol. i., 1896.
24	Landerer and Glucksmann.	M.	50	10 or 15 years' pain, hæmatemesis, and melæna. Eight months before patient had had all the symptoms of perforation, but at the operation no ulcer was found; blood-stained fluid was seen to escape from near the duodenum. Admitted with peritonitis.	General septic peritonitis.	Died.	Ulcer of second part found at necropsy.	Mittheilungen aus dem Grenzgebiete der Medicin und Chirurgie, vol. i., 1896.
25	Banret and Lardennois.	M.	24	Acute epigastric pain at the end of a meal. Diagnosis lay between appendicitis and duodenal perforation.	Operation in 19 hours. A perforation on the anterior surface of the duodenum near the pylorus was sutured; peritonitis.	Died in 20 hours.	Suture tight.	Bulletin de la Société Anatomique de Paris, 1897.
26	Lardennois.	M.	26	Intense pain on the left side of the abdomen during exertion; vomiting was blood-stained and bilious; diagnosis, appendicitis.	Operation in 56 hours. Incision over appendix; peritonitis found; drainage.	Died in 30 hours.	A perforation was found in anterior wall near pylorus.	Bulletin de la Société Anatomique de Paris, 1897.

TABLE I.—OPERATIONS FOR ACUTE PERFORATING DUODENAL ULCER—(Continued).

No. of case.	Recorder.	Sex.	Age (years).	History.	Condition found and nature of operation.	Result.	Remarks.	Reference.
27	Soligoux.	M.	—	A sudden attack of pain and colic.	Perforation of the first portion of the duodenum. Suture.	Died in 12 hours.	—	Bulletin de la Société Anatomique de Paris, 1897.
28	Beausse.	M.	—	A policeman; sudden attack of pain while on duty. Diagnosis of biliary colic; 30 hours after the onset vomiting and distension; diagnosis of appendicitis or intestinal obstruction.	Operation in 48 hours. General peritonitis discovered.	Died in one hour.	Necropsy revealed a perforation just beyond the pylorus.	Journal de Médecine de Paris, 1897.
29	Lennander.	F.	25	History of gastric troubles. Gastric pain was followed by general tenderness and tympanites; diagnosis of appendicitis.	Operation in four days. Incision made over the appendix. General peritonitis.	Died in four days.	Necropsy revealed a perforation close to pylorus. A second ulcer was present.	Mittheilungen aus dem Grenzgebiete der Medicin und Chirurgie, 1898.
30	Lennander.	F.	34	Long history of gastric troubles; pain, vomiting, and rapid pulse.	Operation 15 hours after. A perforation thought to be in the stomach near the lesser curvature was sutured.	Died in 24 hours.	A perforation was found in the first portion of the duodenum. Three ulcers in the stomach.	Mittheilungen aus dem Grenzgebiete der Medicin und Chirurgie, 1898.
31	Lennander.	M.	37	Long history of gastric troubles; sudden attack of pain when sitting up in bed; vomiting; diagnosis of duodenal ulcer or appendicitis.	Operation 60 hours after. A perforation was found in the anterior superior portion of the duodenum near the pylorus.	Died in 26 hours.	Fibrous peritonitis; an abscess between the stomach and the colon.	Mittheilungen aus dem Grenzgebiete der Medicin und Chirurgie, 1898.
32	Schwartz (operator, Rochard).	M.	46	During exertion a sense of injury and abdominal pain; diagnosis of intestinal obstruction.	Operation in five days. General peritonitis, with pus and lymph. On the superior surface of the duodenum near the pylorus a large ulcer was sutured.	Died in two hours.	—	Bulletin et Mémoire de la Société de Chirurgie, 1898.
33	Schwartz (operator, Guinard).	F.	30	History of indigestion; sudden pain during breakfast; diagnosis of perforated gastric ulcer.	Operation after 28 hours. Incision above the umbilicus; escape of gas, bile, and pus. A perforation was found in the right side of the second portion of the duodenum. Opening sutured; drainage.	Died in 14 hours.	Necropsy showed a second ulcer lower down.	Bulletin et Mémoire de la Société de Chirurgie, 1898.
34	Schwartz (operator, Sieur).	M.	23	History of gastric ulcer; sudden attack after drinking coffee; distension, pain, and vomiting.	Operation after 48 hours. General peritonitis; perforation in posterior superior wall of first portion; sutures tore through. The ulcer was walled off by sutures in the omentum.	Died in 36 hours.	General peritonitis; no other lesion.	Bulletin et Mémoire de la Société de Chirurgie, 1898.
35	Wanach.	M.	22	Acute attack three hours after a meal, pain, tenderness, &c.; diagnosis of appendicitis.	Operation in 15 hours. Incision over the appendix; general peritonitis; appendix removed. A second incision showed a perforation in the anterior wall of the first portion; this was sutured.	Recovery after serious and prolonged illness.	Wound was packed with iodoform gauze, and did not heal completely for three months.	Archiv für Klinische Chirurgie, 1898.
36	Whipple.	M.	38	History of pain three hours after food; sudden acute attack of pain; collapse and distension.	Operation after 72 hours. A perforation was found in the anterior wall of the duodenum near the pylorus.	Died in eight hours.	Pus between the liver and diaphragm.	Brit. Med. Jour., vol. ii., 1898.
37	Routier.	M.	30	History of indigestion; sudden severe pain during exertion; abdomen painful, distended.	Operation after 27 hours. Pus in the pelvis and on the right side; general peritonitis.	Died in nine days from pneumonia.	A perforation in the duodenum was partly closed in by adhesions.	Bulletin et Mémoire de la Société de Chirurgie, 1899.
38	Taylor.	F.	17	Indefinite abdominal pains, looked upon as due to appendicitis; collapse.	Operation in 12 hours. Incision over appendix. Perforation was found in the anterior wall of the third portion. Purse-string suture, supported by others; drainage.	Recovery; suppuration along drainage tracks.	—	North Carolina Medical Journal, 1899.
39	Erdmann.	M.	30	Sudden pain in the abdomen, followed by shock and toxic symptoms; diagnosis of appendicitis.	Operation in 36 hours. A perforation was found in the first portion of the duodenum.	Died in a few hours.	—	Medical Record, 1899.
40	Erdmann.	M.	40	Seized with pain while at work; shock; toxic symptoms; collapse.	Operation in 20 hours. Perforation in the first portion of the duodenum	Died in a few hours.	—	Medical Record, 1899.

TABLE I.—OPERATIONS FOR ACUTE PERFORATING DUODENAL ULCER—(Continued).

No. of case.	Recorder.	Sex.	Age (years).	History.	Condition found and nature of operation.	Result.	Remarks.	Reference.
41	Brooks.	M.	29	The patient was an alcoholic. For three years he had had gastric trouble; after a debauch he had bad abdominal pain, vomiting, and distension; diagnosis of appendicitis and peritonitis.	Operation from one to two days after attack. The appendix was removed and one quart of fluid escaped.	Died in 30 hours.	Perforation was found in the first portion of the duodenum.	Medical Record, 1899.
42	Weir.	M.	30	History of gastric troubles; sudden epigastric pain, vomiting, and prostration; distension and tenderness.	Operation after four days. A perforation found in the anterior superior wall of the duodenum close to the pylorus was sutured.	Died in a few hours.	—	Medical Record, May 5th, 1900.
43	Johnson.	M.	27	The patient was an alcoholic; sudden severe pain in the upper abdomen; chill.	Operation in 10 hours. Bile-stained fluid escaped. A perforation found on anterior surface of descending portion was sutured; flushing.	Recovered.	—	Annals of Surgery, 1899, p. 634.
44	Elliott.	M.	—	No history.	Ulcer at the back of the duodenum was stitched with difficulty.	Died from hæmorrhage.	—	Boston Medical and Surgical Journal, 1900.
45	Elliott.	M.	—	No details.	Operation on fifth day. General peritoneal infection. Ulcer was sutured.	Died on third day.	—	Boston Medical and Surgical Journal, 1900.
46	Perkins and Wallace.	M.	52	Epigastric pain of three days' duration, suddenly increased; a diagnosis of perforated duodenal ulcer.	Operation in 10 hours. An opening was found at the junction of the first and second portions. Suture; drainage.	Recovered.	—	THE LANCET, Feb. 17th, 1900, p. 468.
47	Bolton.	M.	20	Seven months' history; sudden severe pain in the right side; tenderness over the appendix; diagnosis of appendicitis.	Operation in 20 hours. Incision over the appendix allowed escape of odourless gas and fluid.	Died in 24 hours.	Necropsy revealed a perforation just beyond the pylorus.	Medical Record, March, 1900.
48	Bolton.	M.	45	The patient was an alcoholic. Four years previously an attack of severe pain in right side; distension; tenderness; diagnosis of appendicitis.	Operation in 22 hours. Incision over the appendix; escape of turbid serum; flushing; drainage.	Died in seven days.	Necropsy revealed a perforation in the anterior wall just beyond the pylorus.	Medical Record, March, 1900.
49	Christy Wilson.	M.	48	Several years of indigestion; sudden seizure of pain while at work.	Operation after 28 hours. Immediate escape of bile-stained mucus. A perforation found about one inch from the pylorus; General peritonitis; two layers of sutures.	Recovered.	—	THE LANCET, June 15th, 1901, p. 1681.

In compiling this list I have disallowed certain cases which have been accepted by other writers. These are Bolton's first case (there is no post-mortem record); Lennander's third case (a case of chronic perforation with the formation of periduodenal abscesses); and Routier's case of chronic perforation with abscess. The total number, including my own two cases related above, is 51 with eight recoveries.

had any symptoms of poisoning. In my first case it was obvious that the duodenum at the point of ulceration was so narrowed by the suturing that a marked stricture of the bowel would inevitably result, if the patient survived. I therefore gave an alternative route from the stomach by performing gastro-jejunostomy. This procedure is one to which I desire especially to call attention, as it will doubtless prove, in some few cases, of the greatest service. In Case 34 in the table related by Schwartz (operated upon by Sieur) and in Festal's case, where the ulcer occupied two-thirds of the circumference, it would have been an advantage. If, as rarely happens, there is difficulty in effecting a complete suture, or if, as in Landerer and Glucksmann's case, the opening of the ulcer cannot be found, a new outlet from the stomach would give some measure of rest to the duodenum and thereby facilitate healing. Omental grafts or flaps may be used to secure the "walling-off" of the ulcer.

2. *When subacute or chronic perforation leads to periduodenal or subphrenic abscess.*—Periduodenal abscesses are opened through the abdominal wall in front, subphrenic through the anterior or lateral walls of the abdomen, or through a low intercostal space. If the perforation is discovered, as in the third case related by Lennander, it should be closed by suture, and a drainage tube should be passed

down to the abscess cavity, and should be left in for two or more days. The following case has been under my care.

CASE 3.—The patient, a female, aged 29 years, was admitted into the Leeds Infirmary on Sept. 29th, 1900. She complained of having had several acute attacks of pain, accompanied by vomiting, during the last five years. The first attack occurred after her confinement, and lasted for five days. There was blood in the vomit on that occasion, and blood had been noticed irregularly since. The motions had never been observed. The attacks had appeared without apparent cause. There had always been a sense of discomfort after meals, appearing from one to four hours after food. The diet had not been a full or a generous one for the last two or three years, and the patient was said to have been "fanciful" in her selection of food. There had never been jaundice, and no alteration had been observed in the condition of the urine. On admission the patient seemed, and looked, to be quite well. She was kept in bed and given a light diet. On Oct. 4th she had an attack similar to those from which she had previously suffered. The temperature was 101° F. and the pulse was 100. Vomiting occurred at intervals for three days; there was no hæmatemesis. The right upper quadrant of the abdomen was exquisitely tender and the muscles

formed so rigid a defence that examination was impossible. Pain above and a little to the right of the umbilicus was severe. The patient looked ill and anxious. The motions were normal. After the attack had subsided the stomach was more carefully examined and found to be dilated, reaching three-quarters of an inch below the umbilicus. A diagnosis of pyloric ulcer with perigastritis was made. On Oct. 12th the abdomen was opened between the linea semilunaris and the middle line. Many adhesions were

and left the hospital, the wound being entirely healed on Nov. 5th.

3. *When pain and gastorrhagia or enterorrhagia are persistent and disabling.*—Case 4 in my list is an admirable example of this form. The treatment of such cases is by the performance of gastro-enterostomy. The amount of food passing over the ulcer is reduced considerably (the greater part going by the new opening), and the rest so secured permits the healing of the ulcer.

TABLE II.—CASES OF CHRONIC DUODENAL ULCER.

No. of Case.	Date.	Sex.	Age (years).	Symptoms and description.	Condition found and nature of operation.	Result.	Remarks
1	January, 1900.	F.	41	At the age of 16 years the patient had had an illness, attended with the vomiting of blood, on one occasion in large quantity. She had had pain after food ever since, at times better, at times worse. The diet had been carefully and rigidly supervised. In June, 1899, pain began to be much more acute, and vomiting, which before had been inconstant, now became frequent. Large quantities (four pints) were vomited. On examination of the abdomen a large contracting stomach was seen. Nothing abnormal was felt over the pylorus.	Thickening at the pylorus, and along the first portion of the duodenum, with contraction and many adhesions. The adhesions were carefully broken down, and gastro-enterostomy was performed.	Recovered.	Quite restored to health; eats well and suffers no pain.
2	January, 1900.	M.	55	Dyspepsia for 10 years; periodic seizures of copious vomiting at intervals of from 24 hours to three weeks.	Enormous stomach; thickening at the pylorus and along the first portion of the duodenum; cicatricial contraction very marked; adhesion to liver. Gastro-enterostomy was performed on two occasions, first with Laplace's forceps and then with Murphy's button.	Recovered.	Seen in July, 1901; had gained two and a half stones and could eat perfectly well.
3	Feb. 16th, 1901.	F.	31	For some years there were pain after food and diarrhoea; pain came on about half-an-hour after food and lasted for three hours or more; hæmatemesis.	Three ulcers were found, two in the stomach near the lesser curvature, one in the first part of the duodenum with considerable induration. Posterior gastro-enterostomy.	Recovered.	Complete relief.
4	March 3rd, 1901.	M.	30	The patient was sent to me by Mr. G. Millhouse and Mr. G. P. Anning with a diagnosis of duodenal ulcer; symptoms had persisted for five or six years. There were pain in the epigastrium after meals and vomiting; had attacks of faintness and prostration, followed by melæna and anæmia.	An ulcer was found in the first part of the duodenum with many adhesions; small scar of gastric ulcer on the posterior surface of the stomach. Gastro-enterostomy.	Recovered.	Complete relief; on May 31st had gained 12 pounds.

found around the pylorus, duodenum, and gall-bladder. On separating these an abscess cavity holding three ounces of pus was discovered. It lay between the liver and duodenum. The duodenal wall was thickened and indurated and there was an ulcer at the junction of the first and second portions which had perforated and caused a localised periduodenal abscess. The liver, gall-bladder, and bile-ducts were intact. A drainage-tube with a sterilised gauze wick was introduced. The patient did well

4. *When cicatricial contraction and induration or periduodenitis are present.*—In such cases the symptoms are those of dilated stomach and a diagnosis of pyloric narrowing will generally be made. Gastro-enterostomy will give complete relief. A case of ulcer, causing stenosis, in the fourth portion of the duodenum is related by Rewitzow. Gastro-enterostomy was performed. My experience extends to four cases, the notes of which are given in Table II.
Leeds.

EXPERIMENTAL HÆMOGLOBINURIA
CAUSED BY A BACTERIAL TOXIN.
BY CHARLES TODD, M.D., D.P.H. CANTAB.,
ASSISTANT BACTERIOLOGIST, ANTITOXIN DEPARTMENT, JENNER
INSTITUTE OF PREVENTIVE MEDICINE.
(Preliminary Communication.)

It is well known that the injection into the blood-stream of certain substances which have a solvent effect on the red blood corpuscles gives rise to the appearance of hæmoglobin in the urine. This has been described as the result of the injection of certain simple chemical bodies (e.g., distilled water, glycerine, &c.), and of the sera of other animals. Since the discovery of tetanolysin by Ehrlich a series of hæmolysins has been described as produced by various organisms—e.g., bacillus pyocyaneus,¹ staphylococcus aureus and albus,² bacillus diphtheriæ, micrococcus tetragonus, streptococcus pyogenes,³ and bacillus typhosus,⁴ &c.

¹ Bulloch and Hunter: Centralblatt für Bakteriologie, 1900, Band xxviii., p. 865.
² Neisser and Wechsberg: Zeitschrift für Hygiene, 1901.
³ Lubenau: Centralblatt für Bakteriologie, 1901, Band xxx., p. 356.
⁴ E. Levy and Prosper Levy: Centralblatt für Bakteriologie, 1901, Band xxx., p. 405.

These organisms, however, are all pathogenic for animals, and their hæmolytic action, which in most cases is comparatively feeble, is masked by other more obvious pathogenic effects. A more suitable organism for the study of experimental hæmoglobinuria is found in the bacillus megatherium, which, when grown in suitable media, gives rise to the formation of products which are very powerfully hæmolytic for the corpuscles of certain animals without causing death or serious illness from other pathogenic effects.
The hæmolytic action of the bacillus was first observed in the course of some experiments with a sample of papain in powder. It was found that the powder contained a strongly hæmolytic bacillus which on isolation proved to be the bacillus megatherium. A culture of the same bacillus was obtained from hay infusion, and these two races, together with one of the bacillus megatherium (De Bary) obtained from Kral of Prague were used in the following experiments. These three, though showing slight cultural differences, appear to be all races of the same bacillus. Parallel experiments were done with the three races, which were grown in alkaline broth in Erlenmeyer flasks at 37° C., and the hæmolytic power of the cultures was tested daily on a 5 per cent. suspension of guinea-pigs' washed corpuscles in 0.75 per cent. saline.
Formation of the hæmolysin.—The formation of the hæmolysin, which is in the main extra-bacillary, begins
A A 3