I think it most important to try to determine at the primary operation which cases need permanent drainage and which do not, and not to wait for a recurrence of symptoms to point us to the error of our way, for it is my opinion that this malady is not only a more frequent one, but much more important than is the general belief.

The following from Mayo Robson¹ is very much to the point:

A simple drainage of the gall-bladder by cholecystotomy is frequently unsatisfactory and cannot be relied on in well-marked cases of obstruction, as drainage of the bile passages is not sufficiently long-continued. This applies especially to the cases in which the interstitial pancreatitis has persisted for some length of time, in which cases, although a cholecystotomy may lead to a disappearance of the jaundice and the digestive symptoms may be alleviated, the metabolic signs found in the urine many months, or even years subsequently, show that recovery has only been partial.

To my mind it is most important to draw a distinction between chronic pancreatitis due to gall-stones and chronic pancreatitis due to infection independent of and apart from the presence of stones; in the first case simple removal of the stones and temporary drainage of the gall-bladder gives permanent relief, because we remove the cause of the disease: in the other case, however, the trouble lies outside of and independent of stone formation, and these cases, within the bounds of my experience, at least, are much more likely to require permanent drainage to affect a cure. On this point Mayo² says:

I am impressed with the fact that chronic pancreatitis is not only a more frequent malady than has been supposed, but a more important one. In looking back over considerable experience in surgery of the gall-bladder and bile-tract, I find that a number of cases that have failed to make a good recovery, failed because of pancreatic complications. It is certain that a much larger proportion of cases, especially those with a distended gall-bladder and dilated common duct, with or without stones, should be treated by a cholecystenterostomy, than has been the practice among surgeons.

This position has been forced on me by an experience which I believe is rather unusual. Very briefly it is as follows: I have had in all fifteen cases of chronic pancreatitis; out of these cases the first twelve patients were treated by cholecystotomy, with the result that nine out of the twelve returned for a second operation, made necessary by a recurrence of the symptoms, at which time cholecystenterostomy was done. I have heard recently from eight out of these nine patients and they all report their general health and strength as being in every way satisfactory. Of the nine patients reoperated on in only one was the pancreatitis associated with gall-stone disease. In the last three cases I have felt justified in making permanent drainage at the primary operation, with the result that the trouble was ended at once. In a recent article Ochsner says, "In rare cases in which the common duct is permanently obstructed, cholecystenterostomy may be indicated." In fully half of my secondary operations for this trouble the patency of the common duct has been proved by passing a probe through the duct into the duodenum, and yet recurrence has taken place.

My experience is, I believe, unusual; the number of cases in which there has been recurrence is out of the ordinary and will probably never be paralleled. I would not for a moment encourage the inference that I believe

that two-thirds or one-half of the patients treated by simple drainage would have to be operated on again, but I do insist that this experience is so striking as to merit serious attention; and, incidentally, it suggests that the future will have to determine between temporary or permanent drainage for certain cases of infection of the gall-bladder and biliary passages. There has been one death in this series of cases from ether pneumonia.

I feel, then, that this conclusion is justified: When operating for chronic pancreatitis, if the conditions present do not necessitate cholecystenterostomy, they do present the strongest possible reasons for not making permanent drainage.

PATHOLOGY OF GALL-BLADDER AND BILE-TRACTS*

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In the study of the pathologic physiology of the gall-bladder and gall-tracts we are constantly confronted by the facts that all the various digestive organs, the liver, duodenum, pancreas, stomach, etc., are functionally synergistic, and not, as was formerly supposed, separate and incoordinate units, and that disease in one portion may manifest itself primarily by symptoms referred to an entirely different part. There are also universal symptoms, symptoms common to disease of any part of the digestive tract, which are still considered as neuroses due in some mysterious way to anything or to nothing in particular. The symptomatology of the diseases of the digestive tract is very confusing; and we need not wonder therefore why nearly all diseases of the gall-bladder and bile-tracts are not recognized early and are permitted to develop into dangerous and serious complications before operation is undertaken. Since the pancreas has the fatal defect of sharing terminal facilities with the common bile-duct, and since to that unfortunate arrangement the majority of the diseases of the pancreas are due, for this exposes it to infections and diseases of the gall-bladder and ducts, the early recognition and removal of the pathologic conditions in the gall-bladder and bile ducts is of paramount importance. It is the object of this paper to review the pathology of these conditions and their bearing on an early diagnosis.

Gall-stones are by far the most important pathologic factors we have to deal with. The most important factors which contribute to their formation are stagnation and infection. In old age the muscular tissue about the bile passages atrophies, and this interferes with normal movements of the bile. Lacing and pregnancy in women, and abdominal tumors and adhesions have a tendency to distort the bile passages; these conditions also produce stagnation by pressure. Heredity also plays a part in predisposing to the formation of gall-stones. Stasis is the great factor favoring the development of an infection of the biliary passages. Bile is usually sterile in spite of the open communication that exists between the common duct and the intestinal tract. The current of flow carries material into the intestines, and, even though bacteria are artificially introduced into the bile, they may be carried away by the current without doing any harm. On the other

1. Robson and Cammidge: *The Pancreas, Its Surgery and Pathology*, p. 446.

2. Mayo, W. J.: *Surg., Gynec. and Obst.*, December, 1908, p. 611.

* Read in the Section on Surgery of the American Medical Association, at the Sixty-first Annual Session, at St. Louis, June, 1910.

hand a mere ligation of one of the larger bile-ducts in an animal often suffices to set up an inflammation.

The following facts have been cited in support of the view that infections of the biliary tracts enter by way of the portal vein more frequently than by the common duct. Adami and Ford have asserted that there is a constant passage of bacteria through the mucosa of the healthy intestines; bacteria introduced into the blood may be excreted in the bile (Cushing). The bacteria causing cholecystitis are often not those found commonly in the duodenum. The infection of the biliary passages above a ligature around the common duct could hardly come from an ascending infection. Finally if an enteritis be caused by the administration of arsenic, etc., and if the animal is fed some easily recognizable organisms, such as *Bacillus prodigiosus*, the organisms can often be demonstrated in the bile passages. These facts render it very probable that infection frequently takes place by route of the portal vein. The bile is apt to contain bacteria in pneumonia, typhoid fever and other infections. The bacterial infection produces an inflammation of the mucous membrane and a desquamation of its epithelial cells. These latter contain undissolved cholesterin. They likewise contain calcium salts and these probably react to form the insoluble calcium salt of bilirubin. From this salt, as well as from the amorphous cholesterin in the cells, the biliary calculus takes its origin. Its further growth is carried on by the deposition and recrystallization of new material, especially of cholesterin. Pancreatitis about the common duct also may favor the formation of gall-stones.

In the diagnosis of gall-stones and cholecystitis the history is of great importance and little attention should be paid to the erroneous statement that gall-stones produce no symptoms until impaction takes place. We must also disregard the age of the patient or at least remember that gall-stones can occur before middle age. In fact we should look on every patient who presents himself with indigestion as having some serious lesion of the stomach or gall-bladder, perhaps with complications—till the seriousness is disproved.

The most prominent symptoms of gall-stone disease are a history of long-standing dyspepsia, a capricious appetite, constipation, marked flatulence, independent for the most part of the taking of food, associated with discomfort when the stomach is empty and with comparative ease at night after eating a little. In gall-stone disease we have often at the beginning a sense of constriction but not of actual pain and this sense of constriction is accompanied by a sensation of chilliness which is characteristic. Jaundice, hematemesis, etc., are all late symptoms which will clear up the diagnosis but so late that complications are always present.

From the surgical standpoint it does not make any difference whether we have gall-stones, gastric or duodenal ulcers, pericholecystic or perigastric adhesions; the same incision will relieve them all.

Inflammation of the gall-bladder and bile tracts may depend on causes originating within the ducts, as formation and retention of gall-stones or micro-organisms brought to them from the circulating blood, from the bile or ascending from the intestines. Disease of the pancreas also may cause inflammation in these parts by obstruction of the common duct. Even the majority of tumors of the gall-bladder, the carcinomas, are frequently the result of the trauma and continuous irritation resulting from gall-stone disease.

The disturbances produced by diseases of the gall-bladder and bile-ducts may be conveniently grouped under the following headings:

1. The resulting jaundice.
2. The result of the occlusion of bile from the intestines.
3. The accompanying pancreatitis.
4. The effect of occlusion of the pancreatic secretion from the intestines.

THE RESULTING JAUNDICE

Whenever the lumen of the common duct or both hepatic ducts are obstructed from any cause and the liver cells continue to secrete bile, then the gall-bladder and bile passages become filled with the secretion, the bile pressure within them increases, the liver cells are separated and the bile is absorbed in the lymphatic system or directly into the blood. Thence it is distributed and deposited in various tissues. The bile salts are the most toxic of the constituents of the bile that pass into the blood and are responsible for some of the resulting toxemia. The presence of bile also interferes with the coagulating power of the blood, and prevents operation in some cases on account of the tendency to hemorrhage by diapedesis.

THE EXCLUSION OF BILE FROM THE INTESTINES

The exclusion of bile from the intestines interferes seriously with the absorption of fats, only about 40 per cent. of the fats taken in the food being absorbed, as to the normal 90 per cent. In cases in which the bile is occluded from the intestinal tract we must pay close attention to the diet so as to maintain the nutrition of the patient. The diet should consist principally of proteids and of higher carbohydrates. Fat should not be given, for if present, it will undergo excessive cleavage through the action of intestinal bacteria and pancreatic ferments. The products of the decomposition are very irritating and are responsible for the diarrheas and other disturbances present. What influence the absence of bile exercises on the bacterial decompositions of the lower intestinal tract we are not surely informed about. We know, however, that the putrefaction of proteid material is increased.

THE ACCOMPANYING PANCREATITIS

According to studies made by Dr. C. H. Hoffman, pathologist of the College of Physicians and Surgeons of Little Rock, Ark., the most frequent causes of acute and chronic pancreatitis are gall-bladder and duct diseases. Mayo in 325 operations on the common and hepatic ducts found the pancreas involved in 22 of the cases. Quénu and Duval estimate the simultaneous occurrence of gall-stone disease with chronic pancreatitis as being close to 50 per cent. Williams and Bush in a collection of 83 cases chronicle their presence in nearly 40 per cent. Egdahl analyzed 105 cases and concluded that 42 per cent. of the cases of acute pancreatitis were associated with gall-stones, and inclines to the opinion that they are the most common causes of pancreatitis.

Opie established the proof of this relationship in a post-mortem in a case of Osler's operation by Bloodgood, in which a small stone occluded the ampulla of Vater, forming thereby a continuous passage for the bile from the common duct into that of the pancreas. This he supplemented later by the addition of seven other cases and inferred that in many cases the stone may be lodged temporarily, but long enough to damage

the pancreas, and then may escape, without leaving any further evidences of its impaction. Half of the cases examined by Opie showed more or less contraction or obliteration of the duct of Santorini so that it could not perform the functions of Wirsung's duct, when that duct was obstructed by the ordinary passage of an average-sized gall-stone through the pancreatic portion of the common duct without impaction at the ampulla. From this we understand that the actual lodgment and retrojection of bile frequently takes place.

Pancreatitis can be produced also by regurgitation of the contents of the duodenum into the diverticulum of Vater, the route having been opened by the passage of a gall-stone. The head of the pancreas encircles the common duct in nearly two-thirds of all cases. Stones lodged in that portion of the duct press on the pancreas and produce partial if not complete obstruction of its secretion, which can be readily infected either from the duodenum through Santorini's duct or through the ampulla of Vater. The bile is nearly always infected in all cases of common-duct stone and we must consequently anticipate more or less virulent infections of the pancreatic secretion from the same cause.

Flexner injected bile mixed with mucus into the pancreatic duct and found that this diluted bile produced only a mild pancreatitis while if the bile was injected undiluted an acute phlegmonous inflammation resulted. This will be sufficient to show that the etiology of pancreatitis is in most cases identical with that of cholecystitis and cholangitis.

THE EFFECT OF EXCLUSION OF PANCREATIC SECRETION FROM THE INTESTINES

Complete exclusion of pancreatic juice from intestines without concomitant exclusion of bile is extremely rare. A closure of both ducts does not occur frequently, and likewise a total degeneration of the secreting glandular parenchyma is rare.

Muller studied the feces of several patients who had extensive pancreatic degeneration, and found the absorption of carbohydrates not at all affected by the disease. He found that the absorption of the proteids was only slightly affected, and that the total quantity of fats absorbed was likewise not far from normal. The cleavage of fats in the intestines, however, was considerably diminished, for of the fat in the feces only 40 per cent. was found split into soaps as against the normal of 84 per cent. Others claim that the absorption of fats is greatly diminished. Weintraub's patient lost 25 per cent. of the fat taken in the food and Doucher's two patients lost respectively 52 and 83 per cent. of the fat taken in the food. Later observers, particularly Croftan, have established that in pancreatic obstruction the stools are bulky, because a great deal of the pabulum fails to be assimilated at all and therefore escapes absorption. There is much fat in the stools and the muscle nuclei pass through the intestine in an undigested form (Schmidt's test); in addition lipase may appear in the urine (Hewlett's test); also pentose (Cambridge's reaction) and much dextrose. Dr. Hoffman informs me that he has found the Cambridge reaction of a great deal of service in the diagnosis of chronic pancreatitis but of no value in the acute form.

TREATMENT

The nature and extent of the operation for gall-bladder and gall-stone disease must depend on the condition of the pancreas.

In gall-stone disease with chronic pancreatitis the removal of the stones with temporary free drainage by

means of a cholecystostomy is generally sufficient. This drainage relieves the infection caused by the stones and also will do away with the pressure which the pancreas exerts on the common duct. Whenever we have reason to believe that the pancreas is involved, unless there is malignant disease of the gall-bladder or the function of the organ has been destroyed by obliteration of its cystic duct, the removal of the gall-bladder is not advisable. A previous history of cholangitis, frequent attacks of jaundice, or calculi in the common duct, all contraindicate cholecystectomy, for keeping the gall-bladder intact will permit a secondary cholecystenterostomy if necessary. It must be constantly borne in mind that the mucus secreted by the gall-bladder has a function and protects the pancreas.

I have long ago been impressed with the importance of chronic pancreatitis and have always advocated that all cases of distended gall-bladder and a dilated common duct with or without stones should be treated by a cholecystenterostomy. The gall-bladder has two important functions, one to secrete protective mucus, and the second to relieve the tension in the common duct at the head of the pancreas. In doing a cholecystenterostomy we should constantly bear in mind the function of the bile in the intestines and should never make our anastomosis between the gall-bladder and the colon unless circumstances demand it. The most logical place for such union is between the gall-bladder and the duodenum as near the opening of the common duct as possible, but in some cases the duodenum is placed so deep or is so firmly fixed by adhesions as to render a union there almost impossible.

In gall-stones and gall-bladder trouble complicated by an acute pancreatitis the pancreas should be incised, free drainage established and it is better to employ the anterior abdominal incision than the posterior one. If the patient's condition will permit it, and there are stones in the gall-bladder or the ducts, or an acute infection of the bile passages, the stones should be removed and drainage of bile established through a right lateral incision. If jaundice is present drainage is imperative.

It will be seen from the foregoing that in all diseases of the gall-bladder and ducts an early diagnosis is the only means we have of preventing serious complications. To wait for repeated attacks of biliary colic, for vomiting, or hematemesis, or pancreatitis to make our diagnosis before operating would be a very dangerous procedure. Since we do not wait for a mastoid abscess to produce a sinus thrombosis, or for a gastric or duodenal ulcer or an inflamed appendix to perforate and produce peritonitis why should we wait for gall-stones to impact and develop a whole train of sequelæ before operating?

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ABSTRACT OF DISCUSSION

ON PAPERS BY DRS. GUERRY AND RUNYAN

DR. L. F. SCHMAUSS, Alexandria, Ind.: It is stated in the literature that gall-stones do not produce symptoms in about 90 per cent. of the cases. In 90 per cent. perhaps gall-stones do not produce symptoms early—that is, typical symptoms, like colic, jaundice, and so forth—but to say that in 90 per cent. of all cases of gall-stones there are no symptoms is wrong, and not according to the observation of anyone who gives the subject serious thought. I maintain that in all cases of cholelithiasis there are symptoms before the patient reaches old age; that in 90 per cent. of them there are more or less serious symptoms before that period, and that in at

least 10 per cent. of all cases of cholelithiasis the symptoms will be so severe as to necessitate operation. These patients all have so-called dyspeptic and neuralgic symptoms for many years, which means that we should give them more attention. Not only are they diagnosed as gastralgia or neuralgia of the stomach, but even as appendicitis, malaria, and so forth, and this statement that 90 per cent. of cholelithiasis cases give no symptoms is to a great extent responsible, I think, for these wrong diagnoses.

A CASE OF DIAPHRAGMATIC HERNIA

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I report this case not only because of the rarity of diaphragmatic hernia, but also because of the abstruse and puzzling symptoms it presented.

Past History.—The patient, W. W., a negro butler, aged 23, had had the diseases of childhood; gonorrhea several times, but denied syphilis. He used alcohol and tobacco in moderation, but denied coming in contact with lead in any form. He had never had a similar illness and was well up to the onset of the present trouble. Ten years previously he had been stabbed in the left seventh intercostal space just lateral to the anterior axillary line. The cut was about 2 inches long, through which a mass looking like fat (as he described it) protruded. The wound was sutured under general anesthesia and an uneventful recovery followed.

Present Trouble.—About 12:30 a. m., July 24, 1910, he entered my service at the Cook County Hospital. He gave the following history: Five days previously a sharp pain started on the left side of the abdomen, about 2½ inches below the costal arch, which grew so severe that he was unable to sleep that night. He vomited, but had no chills or fever. Bowels had been constipated since the onset of the pain, and resisted all cathartics and flushings that a physician had administered. The pain on the left side of the abdomen, which had radiated to the epigastrium, and the vomiting and constipation persisted until entrance to the hospital. On the day before admittance to the hospital, he vomited a brownish material, which, as he expressed it, looked like manure.

Examination.—The patient walked into the ward, but apparently had some pain. He was well nourished. There was no cyanosis or dyspnea; temperature 99.2 F. per mouth; pulse, 64; respirations 24 on admittance. The pupils were equal and reacted to light and accommodation. There was no rigidity of the neck and no lead line along the gums. The throat was negative. The lungs expanded equally on both sides. Dulness began posteriorly one hand's breadth below the angle of the scapula. There were no abnormal palpatory, percussion or auscultatory findings. The pulse was full, slow and regular. The heart was on the left side of the chest, not enlarged and showed no murmurs. The abdomen was not distended, and peristaltic waves could not be seen or auscultated. There was tympany all over. Some tenderness and rigidity were present over the entire abdomen, but especially in the region of the appendix. In the right anterior lumbar region there was an ovoid tumor mass, tympanitic and tender, but not movable. Liver and spleen were not palpable. The genitalia were negative. There was no stricture, prolapse or tumor of the rectum. Knee-jerks were present; no Babinski or ankle clonus. The urine was amber; clear; specific gravity 1,038; no albumin; no sugar; no casts; leukocytes, 6,250.

Course.—Repeated colonic flushings and "1-2-3" enemas were given with no results, and twelve hours after admittance the patient was practically in the same condition as when he entered; so the diagnosis of intestinal obstruction was made, the exact type of which was not known, and an operation decided on. Because of the good condition of the patient and the lack of marked abdominal symptoms, some physicians who saw the patient believed the condition to be an acute catarrhal appendicitis with paralytic ileus.

Operation.—An incision was made in the mid-line of the abdomen. The appendix was normal, but the cecum and

ascending colon were markedly distended. The small intestine was run through, but no obstruction was found. The transverse colon was distended, but the colon below the splenic flexure was collapsed. In the lower border of the diaphragm, just to the left of the median line, was a hole large enough to admit the finger-tip, in which a knuckle of the descending colon was bound down so firmly by adhesions that it was deemed safer to let the obstruction alone, and do a lateral anastomosis between the portion of the colon proximal to the obstruction and the sigmoid. This was done in the usual way. A drainage-tube was inserted in the left side of the abdomen; the peritoneum and fascia were closed with continuous catgut, and the skin was sutured with interrupted silk-worm gut.

Postoperative History.—For four days after the operation the patient had a temperature of 99.8 to 102 F. per rectum, and on July 30, five days after the operation, he had a bowel movement. He then made an uneventful recovery.

The points to be considered in this case are:

1. The long time (ten years) elapsing between the time of injury to the diaphragm and the occurrence of the hernia.
2. The relatively few symptoms of intestinal obstruction and its close resemblance to appendicitis; also the good general condition of the patient, which is not usually seen in intestinal obstruction; and the fact that the patient recovered after being ill six days with an intestinal obstruction, in which condition the mortality is very high after forty-eight hours' duration.

100 State Street.

ACCIDENTS DUE TO SWIFTLY MOVING MACHINES, AND THEIR AUTOMATIC RATIONAL PREVENTION

ESPECIALLY AS CONCERNS INDUSTRIAL CONDITIONS

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The conscientious physician always seeks the removal of the cause of any disease that may come under his treatment when that is possible, rather than the treatment of mere symptoms that tend to recur so long as the cause remains.

We may apply this sound principle with practical results to the prevention of accidents arising from swiftly moving or power-driven machines. If manufacturers or factory owners should have passed in their respective states, a provision or clause in any law as concerns liability between the employer and employee, the respective state insurance commissioners to pass on all details of bond application, based on the following, or a similar method:

The manufacturer, builder, or agent of the machine shall place an indemnity bond with an approved surety company, to the amount of, say, 5 or 10 per cent. of the total cost of the machine, which bond is to run during the estimated life or period of usefulness of the mechanism, as shall be agreed on, such bond to be drawn on by the employer or manufacturer after an accident, for the purchase of safety devices, bulwarks, mechanical guards, etc., to be placed on the specific machine so covered.

This method should insure to the builder or agent of the machine:

1. The avoidance of the moral responsibility of maiming employees for life.
2. The saving of large treasure, if state governments should adopt such a measure, that is wasted at the present