

as the disease progresses the patient loses in weight and strength. As the cysts enlarge they appear as localized prominences in the upper portion of the abdomen, usually in the left hypochondriac region, though they may be present below the navel. The tumors are globular in shape, smooth, and offer considerable resistance. In most instances they are but slightly movable, and are not, as a rule, affected to any great extent by the respiratory act, but instances have been recorded in which they were pedunculated and could be moved into almost all parts of the abdominal cavity. The cysts are, of course, dull on percussion when not covered by the stomach or intestine. The pulsation of the abdominal aorta is not uncommonly transmitted, though the cysts are never expansile. On auscultation a systolic souffle may be distinctly heard in some instances. The tumor by its pressure may seriously interfere with the functions of neighboring organs in addition to its destructive action on the pancreas itself. The pressure in some instances has been so extreme that symptoms of intestinal obstruction have occurred, and jaundice in some cases has been produced. Sometimes the cyst diminishes in size, as in a case reported by Halsted, in which the girth of the abdomen decreased to the extent of twelve inches in ten days. If the entire gland be destroyed, or if its duct be so compressed that the pancreatic juices cannot be discharged, the feces may contain considerable quantities of fat, glycosuria may be present, and the amount of indican in the urine may be decreased. Salivation, as in other diseases of the pancreas, is sometimes noted.

Diagnosis.—Cysts of the pancreas should be suspected in all cases in which successive attacks of severe pain occur in the epigastric region, especially if they be accompanied by pronounced symptoms of collapse. The diagnosis, however, must always remain problematical until a tumor is discovered in the affected region, in which case, conjoined with the symptoms just referred to, the probability of pancreatic cyst should always be considered. Should doubt exist, aspiration may be resorted to, and the fluid obtained tested for pancreatic ferments; but it should always be remembered that in quite a proportion of cases the fluids that occur in these possess no digestive properties, and on the other hand that other liquids sometimes do. From aneurism the cysts may be differentiated by the fact that even when they show pulsation it is non-expansile, and that in the knee-elbow position it entirely disappears. Collections of fluids in the pancreas may be mistaken for ovarian cysts, but may be generally diagnosed by the facts that in the latter condition the increase in the abdomen is from below upward, and that on aspiration the contents of the tumors are rarely blood-stained, do not emulsify fat, and contain no digestive ferments. Cysts of the gall-bladder differ in that they are continuous with the liver, and that on puncture the fluid found corresponds to bile rather than to the juices elaborated by the pancreas. Solid tumors may be distinguished by the fact that they contain no liquids. Cysts of the lesser peritoneum, or mesentery, are differentiated with great difficulty from like collections of fluid occurring in the pancreas, but the absence of digestive properties in the liquids removed from these situations, and the lack of symptoms indicating interference with the proper performance of the functions of the pancreas may serve to make the diagnosis clear.

Prognosis.—Cysts of the pancreas not uncommonly exist for long periods of time without producing any serious results, but they may cause marked disturbances by pressing upon the neighboring organs. Diabetes is sometimes produced by them, though this is comparatively rare. The particular danger is rupture of the cyst into the neighboring cavities.

Treatment.—Of one hundred and one cases collected by Koerte, which were opened and drained, four deaths followed as a direct result of the operation, and one case ultimately ended fatally from infection of a fistulous tract resulting. In fourteen cases the cysts were extirpated, with twelve recoveries.

NEW GROWTHS OF PANCREAS.

Tumors of the pancreas are exceedingly rare, but the neoplasms that occur in the organ are in most instances malignant. Of the tumors that develop in the gland carcinoma is the most common, but sarcoma, adenoma, lymphoma, gumma, and tubercle are occasionally encountered. For the reason that most of the tumors that occur in the organ belong to the group of carcinomata, and inasmuch as the symptoms of other tumors of moment are practically identical with those occurring in this form of the disease, cancer will be alone considered.

CARCINOMA OF THE PANCREAS.—Notwithstanding the great amount of work that has been recently done upon the subject of the etiology of cancer, there is as yet no satisfactory explanation of its causation, and we shall therefore have to be contented with pointing out that carcinoma of the pancreas usually occurs between the ages of thirty and fifty, and that it appears to be rather more frequent in men than in women. The rarity of the condition is evident by the fact that in 36,541 post-mortems the disease was found in only 174 instances.

Morbid Anatomy.—Carcinoma of the pancreas may occur in any part of the organ, but its most frequent site is in the head of the gland. The tumor may be very soft, or, when containing much fibrous tissue, of almost cartilaginous consistency. In some instances the neoplasm is circumscribed and remains confined to one part of the organ; but in other cases it is diffused throughout the entire substance of the gland. It may be very small or quite large, sometimes attaining the size of a cocoanut. The disease does not remain confined to the pancreas, but is prone to extend into the surrounding tissues, notably into the walls of the duodenum. The lymph nodes in the vicinity are sooner or later involved, and secondary nodules may occur in the spleen or liver.

Symptoms.—Until the tumor reaches such a size that it can be palpated, the diagnosis of cancer of the pancreas is exceedingly difficult, and is indeed generally impossible, as the symptomatology of the disease in its incipency is apt to be vague and misleading. In most cases the first manifestations of the affection are disorders of the digestive functions, which in the course of weeks or months are followed by paroxysms of epigastric pain, not uncommonly accompanied by nausea and vomiting. As the tumor increases in size the common duct is in most instances compressed, with the result that jaundice of an intense and persistent kind is induced, and on account of the retention of the bile the gall-bladder is generally greatly dilated. Jaundice sometimes develops slowly, and in other instances with suddenness. On account of the absence of the pancreatic and biliary secretions the feces are apt to be white, and in rare instances to contain an increased amount of fat. The feces when examined microscopically are apt to exhibit many undigested muscle fibres, even in instances in which constipation exists. In some cases the urine is found to contain sugar, and indican is said by some to be considerably diminished in amount. As the tumor increases in size it sometimes causes obstruction of the duodenum, with the result that the stomach and upper part of this viscus become considerably dilated. If it be very large it may impede the portal circulation with the production of ascites, or by pressure upon the inferior vena cava dropsy in the lower extremities may be developed. In rare cases hydronephrosis has been produced in the left kidney as a result of the compression of the left ureter. After the tumor becomes quite large it may be felt, especially if perfect relaxation of the abdominal muscles be brought about by the means of general anaesthesia. It should, however, be remembered that the tumor must be quite large in order that this may be accomplished, for it has not been palpated in more than ten per cent. of all cases in which the disease was undoubtedly present. If carcinoma exist the tumor is deeply seated, and is but slightly movable. It may or may not be tender. In some instances the neoplasm causes hemorrhage into the peritoneal cavity or into the intestine, and this may be so profuse as to

cause death. In the beginning the appetite and general health may be but little changed, and, indeed, increased hunger and thirst may occur, especially if diabetes exist. As the disease progresses the patient, as is usual in all forms of carcinoma, becomes anæmic and loses flesh, which condition may be extreme in the latter stages of the affection. The temperature is apt to be somewhat below the normal.

Diagnosis.—Carcinoma of the pancreas is most likely to be mistaken for carcinoma of one of the neighboring viscera—the liver, the transverse colon, the pyloric end of the stomach, or the duodenum. From carcinoma of the liver it is distinguished by the facts that in the former condition the disease is in almost all instances secondary to cancer of some of the other abdominal viscera, that it is often associated with enlargement of the liver, and that an ascites frequently exists. The tumor in cancer of the liver is situated somewhat higher up than are those of the pancreas, and it is, as a rule, more easily movable. In both diseases jaundice occurs, but is much more common in cancer of the pancreas. In cancer of the transverse colon obstinate constipation as a result of the obstruction usually exists, and this is generally associated with the production of a large amount of indican, quantities of which appear in the urine. In these cases the tumor is more superficial, and is more frequently movable, and the disease is not accompanied by jaundice. In cancer of the pyloric end of the stomach there is commonly a history of intense pain developing an hour or so after taking food, and examination usually reveals the fact that the stomach is greatly dilated, contains much lactic acid, and but little hydrochloric acid. Not uncommonly it will be found that the patient suffering with this malady has vomited blood freely, and jaundice is not so apt to be present. From cancer of the duodenum it is practically impossible to distinguish carcinoma of the pancreas, as the two conditions commonly give rise to symptoms in every way similar. Cancer arising in either of these situations is, moreover, very apt to extend to the other. The symptoms of cancer of the pancreas that are of greatest diagnostic importance are the presence of a deeply seated but slightly movable tumor in the situation normally occupied by the head of the gland, the existence of intense and persistent jaundice, pain in the affected region, rapid emaciation and loss of strength, diminished excretion of indican in the urine, and especially the presence of sugar in this excretion. The absence of the pancreatic juice in the intestine, according to Mueller, results in the diminished splitting up of the fats ingested, and this, if true, in all probability will prove of much value in enabling us to make the diagnosis in obscure cases. For the reason that salol, when taken by the stomach, is decomposed only in the presence of the pancreatic secretion, the absence of carboic acid in the urine after the administration of full doses of this drug points to obstructive lesions of the excretory ducts—a condition which is usually present in carcinoma of the organ.

Prognosis.—When surgical interference is not invoked, death in practically all instances results from carcinoma of the pancreas, but the practicability of removing tumors from this organ has been recently clearly shown; and in cases in which the diagnosis can be made early enough, the operation would offer some hope for the life of the patient.

Treatment.—As we have no drugs that act specifically on carcinomatous processes, treatment is to be entirely of a symptomatic kind. Diastases and small pieces of raw pancreas may be administered with the food with advantage, but the only effect that can follow this is an improvement in the digestive functions. In the early stages an operation may be the means of saving the patient's life, as, according to Koerte, recovery has followed in several cases of this kind after the removal of the tumor.

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PANCREAS. (SURGICAL.)—ANATOMICAL CONSIDERATIONS.—The pancreas lies transversely across the upper part of the abdominal cavity, behind the stomach, on a level with the first and second lumbar vertebrae, and three inches above the umbilicus. The head is contained in the loop of the duodenum, the body lies on the crura of the diaphragm. To the left the posterior surface is in contact with the left kidney and suprarenal capsule. The tail touches the lower part of the inner surface of the spleen. Its average length is from five to six inches, and it weighs from two and a half to three and a half ounces.

The blood supply is from the splenic artery and from the inferior mesenteric and hepatic by the inferior and superior pancreatico-duodenal arteries. The blood is returned into the portal vein by means of the splenic and superior mesenteric veins.

The lymphatics terminate in two glands which lie on the superior mesenteric artery. The nerves are branches of the solar plexus which accompany the arteries entering the gland.

The pancreas is a compound racemose gland, soft in texture, and of a pinkish-cream color (Morris').

The secretion of the pancreas is carried by short canals or ducts to the main duct, the duct of Wirsung, which they join at nearly right angles. The duct of Wirsung turns down through the head of the pancreas and opens into the second portion of the duodenum, together with the common bile duct. The lesser duct, or duct of Santorini, collects the secretion from a portion of the neck and head of the pancreas, and opens into the duodenum 2.5 to 3.5 cm. nearer the stomach. Brewer² states that the older anatomists were wrong in teaching that the duct of Santorini, or smaller duct, usually atrophied; according to him it is practically always present in the human subject.

The pancreas is developed between the two layers of the posterior mesentery from two offshoots from the intestinal tube just below the gastric dilatation. Brewer² calls especial attention to the fact that the pancreas is at this time completely invested by peritoneum, "and only becomes a retroperitoneal organ by the absorption and conversion, into areolar tissue and fat, of the several layers of the posterior mesentery." He then draws attention to the fact that the areolar tissue surrounding the pancreas is continuous with that surrounding the left kidney and the areolar tissue lying behind the colon on the left side.

ACCESSORY PANCREAS.—Tieken states that fourteen cases of accessory pancreas have been reported. This results from lack of fusion of the separate diverticula. These accessory glands may be found in the walls of the stomach or duodenum, or in the mesentery. It has been suggested that these accessory glands may cause diverticulums of the intestine. They have

been found at the tips of such processes. The "pancreas minus" is merely an accessory pancreatic lobule springing from the head of the main gland and it usually extends along the wall of the duodenum. Hyatt

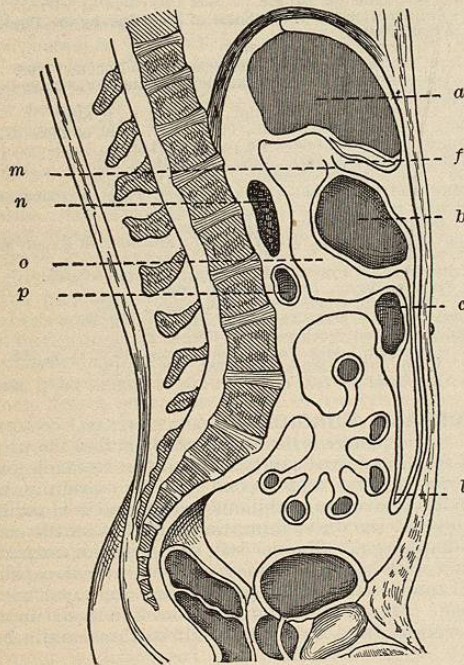


FIG. 3730.—Shows the Normal Relations of the Pancreas to the Stomach, Colon and Peritoneum, as they Appear in a Longitudinal Antero-Posterior Section of the Trunk. (From Kehr.) a, Liver; b, stomach; c, transverse colon; f, foramen of Winslow; l, omentum; m, omentum minus; n, pancreas; o, bursa omentalis; p, duodenum.

speaks of a partial division of the gland by the mesenteric vessels during development. The most important surgical anomaly is described by Tiekens as follows: The neck was of normal size, the head somewhat enlarged. "From the head two bands of glandular substance extend forward in such a manner as to surround the lower part of the descending duodenum, forming a complete ring about its circumference. . . . The duodenum is greatly constricted at this portion, and admits the tip of the index finger with difficulty. . . . The duodenum above the constriction is greatly dilated, forming a sacculum nearly one-half the size of the stomach." Similar cases have been reported by Ecker,¹⁰ Auberg,¹¹ Symington,¹² and Genersich.¹³

"The anatomical relations of the common bile duct and the duct of Wirsung are well known. The common bile duct descends toward the duodenum alongside the head of the pancreas, occasionally embedded in its substance, and comes in contact with the duct of Wirsung, beside which it lies for a short but variable distance before entering the wall of the intestine. The two ducts penetrate, side by side, the coats of the duodenum, and after passing obliquely a distance of about 2 cm. and causing a papilla-like elevation of the mucous membrane, unite to form a short cavity—the diverticulum of Vater. Near its termination at a point where the two ducts are in contact, the common duct becomes constricted, and it is here that a foreign body passing downward, tends to lodge" (Opie²).

Both ducts may enter the duodenum independently of each other and the hepatic duct. In one case the duct of Santorini entered the stomach.

The pancreas is a fixed organ and does not descend during forced inspiration. Nevertheless, it has been found in diaphragmatic hernias, in congenital umbilical hernias, and in Band's⁴ case the duodenum, pancreas,

and a portion of the ileum and colon were invaginated into the descending colon.

Total extirpation of the pancreas in animals is usually followed by true diabetes, and partial extirpation by temporary or alimentary diabetes.

Persistence of fat in the stools in the absence of jaundice and diarrhoea is an indication of disease of the pancreas, particularly when accompanied by great emaciation.

TRAUMATISM.—The pancreas, from its position, is seldom injured alone. The liver, stomach, and transverse colon lie in front, and if the liver should happen to be enlarged and if the stomach and colon should be full at the time when the injury occurred, the pancreas could hardly escape a frontal attack. It might possibly be injured from behind from a penetrating wound or from a fractured vertebra. On the other hand, the pancreas, as mentioned by Robson,⁵ is soft in consistency and easily bruised. The lobules are not well supported as in the parotid. Blows upon the abdomen or a kick or a fall against a hard object may, under certain circumstances, injure the pancreas. Robson relates the case of a butler who slipped and fell against a knife board projecting from the end of a table at which he was working. The blow was not severe, the man did not even fall to the ground, but acute hemorrhagic pancreatitis followed and the patient died. An exploration for peritonitis followed by an autopsy, revealed the true cause of death. Generally the neighboring organs, the stomach, colon, liver, spleen, and lungs are injured at the same time.

The diagnosis of injury to the pancreas alone is impossible. It can only be inferred from the nature of the accident and from symptoms of shock and hemorrhage. After the abdomen is opened, injuries to neighboring organs will probably be found in addition to that of the pancreas. If the pancreas is torn, an attempt should be made to close the rent by stitches. Hemorrhage may be controlled by gauze packing. It is obviously inadvisable to ligature the superior mesenteric artery. Repair may take place; cysts may subsequently develop. Gangrene of the pancreas has followed injury to the parenchyma.

Perforating wounds of the pancreas are not common. Koerte has collected six cases. They generally result from gunshot or stab wounds, and are nearly always fatal from the complications, such as injuries to the stomach, spleen, lungs, or liver. A definite diagnosis can be made only by an exploratory incision. If the compli-

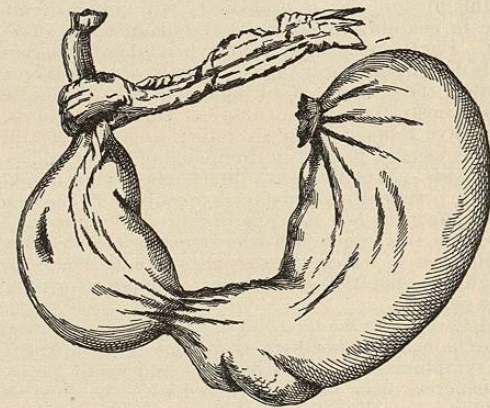


FIG. 3731.—Annular Pancreas with Sacculum of the Duodenum. (From Tiekens.)

cating injuries and the condition of the patient permit, the wound in the pancreas might be closed. The most perfect asepsis should be attained.

Prolapse of the pancreas is difficult to understand, but cases are reported by Kehr.⁴ The tail is the most movable part of the organ. It may be replaced and main-

tained in position, until adhesions have formed, by sterilized gauze packing.

As hemorrhage of the pancreas (or pancreatic apoplexy), acute hemorrhagic pancreatitis, and fat necrosis, are affections which belong to the domain of the physician rather than to that of the surgeon, the reader is referred, for information with regard to them, to the article immediately preceding this.

NECROSIS OF THE PANCREAS.—Necrosis or gangrene of the pancreas may result from different causes. The whole gland may necrose, but more frequently the necrosis involves only a portion. The tail and body are often involved in this process. In other cases the affected areas are numerous and small. The necrotic area may be infolded by peritoneum and ultimately an abscess may form at this point. In two cases reported by Chiari recovery ensued after a portion of the pancreas had been passed per rectum. "In other cases the pancreas is converted into a dark, slaty-colored mass lying nearly free in the omental cavity or attached by a few shreds" (Osler).

The causes of necrosis are to be found in inflammatory suppurative and hemorrhagic conditions of the pancreas itself. It may arise from infections entering from the intestine or through a perforating ulcer of the stomach, as in a case reported by Chiari.²⁰ Syphilitic disease of the blood-vessels and arteriosclerosis are also assigned as causes. Fitz and Koerte have reported about forty cases. A fatal ending is common.

Symptoms.—Many pathological lesions of the upper abdominal region are closely simulated by necrosis or gangrene of the pancreas. A very careful study of the clinical history may throw light on the case. Perforating ulcer of the stomach, gall-stone colic, or perforation of the bile passages may give rise to similar symptoms. A diagnosis of intestinal obstruction has been made on several occasions and laparotomies have been performed without, of course, revealing any obstruction. Pain, tenderness, vomiting, and collapse are present in severe cases, and later, with the formation of pus around the necrotic area, there will probably be an intermittent temperature, a dry tongue, and a feeble pulse. If the patient survives there may develop such complications as peritonitis, pulmonary embolism, metastatic pleurisy, pericarditis, leptomeningitis, and pyæmia. The different courses taken by the pus after abscess formation will be referred to under Suppurative Pancreatitis.

Diagnosis.—A definite diagnosis is possible only after a portion of the necrotic pancreas has been passed per rectum or found by exploratory incision. Kidney lesions might be excluded by an examination of the urine.

Treatment.—During the acute stage but little can be done except to relieve pain; and, if collapse is present, stimulants may be administered judiciously. After encapsulation and pus formation have taken place, surgical interference may be indicated. The abscess may be approached from behind, through the loin or through the pleura, or by an anterior incision through the abdominal wall. Some patients remain well, but diabetes has occasionally developed a year or two afterward.

ACUTE SUPPURATIVE PANCREATITIS.—In 1688 Blancard reported finding small abscesses in the pancreas of a child that had died of variola, and cases have been described in increasing number during recent years. Osler¹⁴ has analyzed 46 cases; of these 28 were men and 11 were women. The age was given in 30 cases. The greatest number occurred between the ages of twenty and fifty, the largest number, 11, between twenty-one and thirty. There may be one or innumerable abscesses. Several small ones may coalesce and form one large abscess. In 24 cases there was a single abscess and in 14 numerous small ones (Osler).

The causes are divided, by Dieckhoff, into three groups. In the first the infection is brought to the pancreas by the blood stream; in the second, the infection comes from some adjacent focus, as, for example, the base of a stomach ulcer which has become adherent to the pancreas before perforating; in the third, the infection passes in from the duodenum through the ducts of Wirsung or Santorini.

It is now quite generally thought that the cause is an infection. The colon bacillus, first found by Welch in the pancreatic ducts, and many varieties of micro-organisms, are now known to be present in the pus. In some cases there is a history of gastroduodenal derangements and of pancreatic and of biliary calculi. Thrombosis of the portal and splenic veins with abscess formation in the liver and spleen are not uncommon. The spleen may not be enlarged even when the splenic vein is obliterated. Inflammation of the peritoneum in the immediate neighborhood is common, that of the peritoneum below the transverse colon rare. When that covering the diaphragm is involved the inflammation may extend to the pleura and pericardium (Fitz).

The abscess formation is seldom confined to within the capsule of the pancreas. Outside the pancreas the pus may collect between the layers of the mesentery or omentum, or in the lesser peritoneal cavity (the foramen of Winslow being closed), or it may extend back into the loins. Sometimes it burrows down behind the descending colon to the pelvis (Koerte). Fat necrosis is rare in suppurative pancreatitis (Fitz).

Symptoms.—The onset is generally sudden and characterized by severe pain in the epigastrium. The pain and tenderness may be referred to one or the other side of the median line if the lesion is limited to the tail or head of the organ. In some cases there is no pain. Vomiting is usually present. There may be constipation or diarrhoea, sometimes colliquative. The temperature varies. Absence of fever is rare. Chills are frequently present. According to Fitz more or less jaundice is present in one-fourth of the cases. Albumin and sugar in the urine are sometimes found, but fat in the stools seldom.

Koerte in four of his cases observed a grayish-brown discoloration of the skin. In one case Bloodgood²² observed a leucocytosis of 19,000, tumor formation, blood and pus in the stools.

Diagnosis.—The diagnosis of an abscess confined within the pancreas is impossible. The symptoms are not distinctive. The discovery of a tumor in the pancreatic region is suggestive. If by inflating the stomach and transverse colon it can be demonstrated that the tumor lies between them and is free from either, it would be evidence of pancreatic origin. The absence of any clinical history of gastric or duodenal ulcer and the presence of a history of gall-stones would be suggestive. Fluctuation is seldom to be directly made out. If there is bulging in one loin and an examination of the urine gives no evidence of kidney lesion, Koerte thinks it might be justifiable to use an exploratory needle. The diagnosis is generally made by an exploratory incision.

Kehr²³ states that in the great majority of cases the course is chronic. Cases are reported which have run a course of nearly a year. On the other hand, some cases are very acute and end fatally within a few days. Abscess may be said to be always fatal unless the pus escapes spontaneously into the stomach or intestine, or is evacuated by the surgeon. Koerte²⁴ emptied these abscesses through an incision in the loin and in other instances by anterior incision. The lumbar incision is to be chosen when there are indications that the pus is near the kidney. The anterior incision should generally be made in the middle line. If, however, a palpable tumor lies to one side, the incision is best made over the prominence. If the anterior wall of the sac is adherent to the anterior abdominal wall the cavity may be washed out and packed with gauze; otherwise great care should be taken to prevent the spread of infection by careful packing with sterilized gauze pads. If possible the wall should be sutured to the abdominal incision. If this is not feasible careful packing with gauze around a large drainage tube, or the building of a drainage canal from omentum, is the only resource. The operations are very simple. If, however, the abscess is confined within the capsule of the pancreas, the operation, as remarked by Boeckel,²⁵ is more delicate, laborious, and restrained; delicate, because the pancreas is deeply situated and is surrounded by numerous important vessels the wounding or ligaturing of which might prove

fatal (superior mesentericus); and restricted, because only a small portion of the pancreas can be removed with safety and freedom from the danger of a fatal diabetes.

CHRONIC PANCREATITIS.—Although suppurative pancreatitis may run a slow and chronic course, the term chronic pancreatitis is used to designate a hardening of the pancreas, with enlargement or shrinking. Perhaps the terms hypertrophic cirrhosis and atrophic cirrhosis would be appropriate. A part or the whole of the gland may be involved. Opie²⁶ recognizes two varieties. In the interlobular form the inflammatory process is localized chiefly at the periphery of the lobule; in the intralobular process is diffuse, involving the lobules and separating individual acini. Of great interest is the relation of chronic pancreatitis to the islands of Langerhans and the occurrence of diabetes. The islands of Langerhans, as defined by Opie, are composed of cells having the same origin as those of glandular acini, but forming structures which are independent of the secreting apparatus, and in intimate relation with the vessels. In the splenic end of the cat's pancreas they have a definite position within the lobule, each of which contains one of those structures. In the human pancreas they are more numerous in the splenic extremity than elsewhere. Opie claims that prolonged stimulation of the gland does not, as claimed by Lewaschen, transform groups of acini into islands of Langerhans.

In the interlobular variety of chronic pancreatitis the islands of Langerhans do not usually suffer, nor do they when the infective agents come by way of the ducts with which they are not connected. In the intralobular or intracinar variety they may atrophy as the result of pressure. In this way the presence or absence of sugar in the urine in diseases of the pancreas may perhaps be explained.

Etiology.—The causes of chronic pancreatitis are not satisfactorily determined. They are probably varied. Undoubtedly localized indurations may arise from lesions of the neighboring organs, such as ulcer of the stomach or duodenum. A general involvement of the gland may result from hæmatogenous infection, from a mild form of acute pancreatitis, from diseases of the blood-vessels, or from obliterating endarteritis. Opie²⁶ reports two instances of congenital syphilitic pancreatitis in which the patients died respectively three and four hours after birth. In one of the cases it was believed that the disease represented an active stage of a chronic inflammatory process; in the other the process was more advanced and was no longer active. The islands of Langerhans were surrounded by newly formed stroma, but in neither case were they invaded by it.

Clinical experience would seem to indicate that in the majority of cases the condition arises from an infection entering through the ducts, secondary to a gastroduodenal catarrh and a complete or partial stasis of the flow of the pancreatic secretion. Numerous operating surgeons have noticed the frequent association of pancreatitis with cholelithiasis. The pancreatic duct may be completely or partially obstructed by a gall stone or a pancreatic stone; the result may be either a narrowing or an obstructive dilatation. The enlargement and hardness found at the operating table have often given rise to a diagnosis of malignant disease. Alcohol has been thought to be a cause. The disease seldom occurs in drunkards, and when it does it is probably secondary to a gastroduodenal catarrh. It may follow mild traumatism.

Pathological Anatomy.—The characteristic picture is the fibrous thickening of the connective tissue generally throughout the gland or only in limited areas. The head of the pancreas may be much enlarged and of stony hardness. In other instances the gland is diminished in size from contraction of the interstitial tissue. The surface is sometimes smooth and sometimes nodular and of a gray color. There may be an associated condition of fatty or calcareous degeneration. The duct of Wirsung may be dilated, tortuous, or of normal appearance.

Symptoms.—There are no pathognomonic symptoms of chronic pancreatitis. Its presence has usually been dis-

covered during operations or in the autopsy room. Disorders of digestion, pyrosis, vomiting, pain and tenderness in the epigastrium, constipation or diarrhoea, and emaciation are the symptoms usually present and they are certainly not distinctive. There may or may not be some elevation of temperature. Icterus may be present if the common bile duct is pressed upon. Sugar may be present in the urine. Fat in the stools is rare and lipuria still more rare. Walker has shown "that the absence of pancreatic secretion from the intestine, although bile were present in the intestinal canal, led to pale-colored stools." Mr. Cammidge has found "that if the urine of patients suffering from pancreatic disease be boiled for a short time with an oxidizing agent and then the phenyl hydrazin test performed, an abundant crop of delicate yellow needles arranged in sheaves and rosettes was produced" (Robson⁵). A histological examination of the blood may show marked diminution in the number of blood plates. The presence of a hard, palpable, immovable tumor in the region of the pancreas would be a very important symptom.

Prognosis.—The prognosis is grave. Many patients, however, known to be the subjects of chronic pancreatitis, live for years in good health, and the same remark is true of patients who have lost a part of their pancreas through suppuration and necrosis. Experiments upon animals harmonize with clinical experience; some animals can live with one-tenth of their pancreas. The association of syphilis, arteriosclerosis, or obstructive heart lesions would render the prognosis less favorable.

Treatment.—"The treatment of chronic pancreatitis is by abdominal section and drainage; but in this case the drainage is indirect and is obtained by draining the gall-bladder by cholecystotomy, cholecystenterostomy, or duodenocholedochotomy. The exact line of treatment cannot be determined until the abdomen is opened, and for this purpose I prefer, as in all my gall-bladder operations, a vertical incision through the upper part of the right rectus, splitting that muscle to whatever extent is necessary in order to obtain a good view of the diseased region, and to afford plenty of room for manipulation.

"If merely cholecystotomy on a distended gall-bladder is necessary, an incision of one or two inches will suffice; but if the gall-bladder be contracted or if the ducts have to be attacked, an incision of from four to six inches will be required; and if the several layers of the abdominal wall are sutured separately, there is no fear of subsequent hernia. This I can affirm by ample experience. It saves much unnecessary dragging on the parts when operating on the common duct or duodenum to have a free incision, and there is no retractor equal to the hand of a skilled assistant, who with a flat sponge interposed between the spread-out fingers of his left hand and the viscera, will at the same time afford the operator a good view of the field of operation, and with his right hand help in the further steps of the operation.

"If the right costal margin or the edge of the liver be obstructing the view, another assistant may with advantage retract it either by digital manipulation or by means of a wide retractor with a long handle, so that he can stand back a little and avoid embarrassing the operator.

"As a matter of experience I seldom find a second assistant necessary. A sponge in the pouch to the right of the common duct, and one pushed down over the right kidney, help to catch all escaping fluids and to keep the peritoneum clean. When the ducts or the duodenum are opened, sterilized gauze pads are employed to mop up the fluid as it escapes, but none of these is allowed to remain even temporarily in the abdomen. When there are gall-stones present they should be removed, unless the patient is too ill to permit of the complete operation; but in every case drainage must be secured, if possible by cholecystotomy, as in nearly all my successful cases. Moreover, the drainage must not be stopped before the bile has become healthy, and not before the greater amount of bile is being passed by the bowel, which will be certain to occur as soon as the swollen pancreas has subsided, if the duct be otherwise clear of obstruction.

"It might be thought that cholecystenterostomy would be the ideal operation in these cases, but experience says that it is not; for instance, in one of my cases the operation brought so much relief that a cure was being anticipated, yet in the third month relapse occurred and death ensued, apparently simply owing to closure of the new opening between the gall-bladder and duodenum. In one of Mr. Barling's cases in which the gall-bladder was joined to the duodenum, he states 'that although the symptoms were relieved, enlargement of the pancreas persisted.'

"Possibly in some cases the manipulations of the indurated tumor may have detached calculi impacted in the pancreatic duct, and thus led to a subsidence of the pancreatitis, then to an opening of the common duct by the relief of tension, and so to a cure of the patient. The simulation of malignant disease of the head of the pancreas by chronic interstitial pancreatitis would make one hesitate to decline operation in any case of distended gall-bladder, where the patient is in a condition to bear it, or even in any case of chronic jaundice without distention of the gall-bladder, where the general strength is deteriorating as, though it should be recognized that if the disease be really malignant, very little good will be done, and life may even be shortened or only prolonged for a short time; yet if the disease prove to be chronic pancreatitis, a real and permanent cure may be brought about. If a calculus be felt embedded in the head of the pancreas or impacted in the pancreatic duct, it may be reached through the second part of the duodenum by laying open the papilla and exploring the duct, or by dividing the peritoneum passing between the duodenum and hepatic flexure of the colon, and then cutting through the overlying pancreas on to the concretion. If the papilla common to the bile and pancreatic ducts be incised in the duodenum, it does not require suture; and in the cases in which I have explored the ducts by the duodenal route there has been no serious hemorrhage. The anterior duodenal opening only requires closing by a mucous and serous suture. Drainage of the right kidney pouch for from twenty-four to forty-eight hours is advisable, though not always necessary, and this is best done by a stab wound at the most dependent part.

"The result of treatment in this class of cases has been most encouraging, as out of twenty-two cases operated on only one died directly from the operation, and in that case the patient's life was only very slightly shortened, since he was reduced to the last stage of exhaustion before surgical operation was sought. Of those recovering from operation, with the exception of two who died a few months later, complete and perfect recovery ensued. These results contrast very markedly with the surgical treatment of cancer of the pancreas, where nearly half of the cases operated on have died directly as the result of the operation, and in those who have survived life has only been prolonged for a comparatively short time."

The above is from Mayo Robson's address before the American Surgical Association in 1901.

Another very important point has been raised by Mr. Robson, and that is the tendency to troublesome hemorrhage during operation in cases of chronic pancreatitis, particularly when associated with jaundice. This was at one time thought to be due to the cholemia. The suggestion that it is due to the glycerin set free in fat necrosis is not generally accepted. He has found the exhibition of chloride of calcium most useful as a prophylactic. He administers calcium chloride in thirty- to sixty-grain doses, thrice daily, for from twenty-four to forty-eight hours previous to operation; and by enema in sixty-grain doses, thrice daily for forty-eight hours afterward. This he nearly always finds successful in correcting the hemorrhagic tendency.

The close association of pancreatitis and angiocholitis is confirmed by Ferguson, of Edinburgh, who observed in cases of death that he could express a few drops of pus from the duct of Wirsung. It would seem that the indirect drainage of the pancreatic ducts was as rational and successful as drainage of the bile passages in infective

conditions. Kehr has suggested an anastomosis between the intestine and the duct of Wirsung. The technique would be very difficult.

CYSTIC TUMORS OF THE PANCREAS.—Cysts of the pancreas are rare; their nature and origin are obscure. It may be said that probably the majority are retention cysts. The most common cause is generally thought to be chronic indurative pancreatitis. The connective tissue in some part of the gland so presses upon or so distorts the excretory duct that the outflow from a part of the gland is arrested. Senn thinks that in addition there is an alteration in the character of the secretion whereby it becomes no longer absorbable. Another cause may be the obstruction of the duct of Wirsung from pressure of neighboring organs, as for instance from a stone in the common bile duct, or from an obstructive swelling of the duodenum at the point where the duct enters. A catarrhal inflammation of the duct of Wirsung may cause obstruction. A new growth in the head of the pancreas may act similarly.

Minier suggests that cystic degeneration may occur in the pancreas in much the same way that it does in the kidney, testicle, and mammary gland. That cysts may result from hemorrhages into the pancreas is not yet proven. The frequent finding of blood in the cyst contents has suggested this cause. It is probable that small hemorrhages may be entirely absorbed, leaving only a pigmented stain (Orth). On the other hand, it is quite probable that hemorrhages may occur into cystic tumors, and it is generally thought that most bloody cystic tumors of the pancreas are in origin retention cysts. Trauma is also assigned as a cause. Cysts are more frequent in the tail than in the body or head of the pancreas. In an analysis of 134 cases Osler¹⁴ found in 90 cases that the situation was not given; in 14 that the whole pancreas was involved; in 15 the tail; in 11 the head; in 4 the body. Koerte²⁷ states that of 121 cases operated upon by surgeons, 60 were in males and 56 in females; in 5 the sex was not given. Sixty-six of the cases occurred in the fourth decade.

There may be multiple cysts. This should be borne in mind when considering the prognosis and possibility of recurrence. Pancreatic cysts vary greatly in size. Those found in autopsy rooms are usually comparatively small. Surgeons report, however, that some of the cysts contain from 1 to 20 litres. The fluid is generally of a light-brown coffee or reddish-brown color, seldom clear (Osler). Gussenbauer found in the fluid altered red and white blood cells and pigment. Fresh blood has also been found. The chemical reaction as a rule is alkaline, but may be neutral or acid, with a specific gravity of 1.007-1.028.

The lining of the cyst wall may be smooth or sacculated; it is generally surrounded by blood-vessels. In developing the cyst may assume very variable relations to adjacent organs, particularly the liver, stomach, and transverse colon. It may lie behind and push forward the stomach; it may project between the stomach and liver; it may appear between the stomach and transverse colon, or lie behind the colon. The displacement of these organs is sometimes very great. In one instance the transverse colon was pushed down behind the symphysis pubis. Besides the displacement and dragging of the viscera mentioned, other serious complications may arise from the pressure of the tumor. The common bile duct may be so pressed upon that jaundice results. Pressure may cause obstruction of the duodenum or ureter, and cases are reported of pressure resulting in ascites.

There are no symptoms which can be called characteristic of cystic tumor of the pancreas so long as it remains small and not palpable. As might be expected, from what is known of its etiology, there is generally a history of indigestion, of indiscretion in eating and drinking, and occasionally of trauma. Pain in the epigastric region is common, its severity depending on the situation of the tumor and its rate of growth. There may be nausea and vomiting. The vomitus may contain blood if it occurs subsequently to rupture of a cyst into the stomach. If