Hunterian lectures on the pathology and surgery of certain diseases of the pancreas : delivered before the Royal College of Surgeons of England on March 7th, 9th, and 11th, 1904 / by A.W. Mayo Robson.

THE PATHOLOGY AND SURGERY OF CERTAIN DISEASES OF THE PANCREAS.

Hunterian Lectures

ON

THE PATHOLOGY AND SURGERY OF

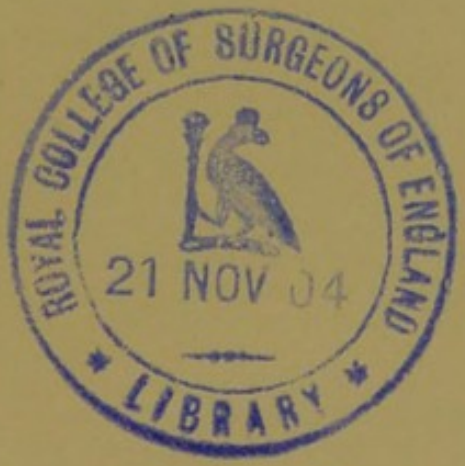
CERTAIN DISEASES OF THE PANCREAS

Delivered before the Royal College of Surgeons of England on March 7th, 9th, and 11th, 1904

BY

A. W. MAYO ROBSON, F.R.C.S. Eng.

HUNTERIAN PROFESSOR, ROYAL COLLEGE OF SURGEONS OF ENGLAND



Reprinted from THE LANCET, March 19 and 26, and April 2, 1904.

Hunterian Lectures

ON

THE PATHOLOGY AND SURGERY OF CERTAIN DISEASES OF THE PANCREAS.

LECTURE I.

Delivered on March 7th.

MR. PRESIDENT AND GENTLEMEN,—Until quite recently the pancreas from a clinical standpoint was almost ignored and it is only since a more exact knowledge of the great physiological importance of the gland, both with regard to its metabolic functions and to the important rôle its secretion plays in digestion, that its pathology has come to hold a first place in modern medicine. It must be within the knowledge of everyone present how little attention used to be paid to the pancreas in the post-mortem room and how often this important organ was passed over with little or no notice, the consequence being that small reliance can be placed on post-mortem records of the past so far as pancreatic disease is concerned, and with few exceptions the pathological museums, of which I have visited the principal in London and a number elsewhere, are very imperfectly supplied with specimens. The impetus given to pancreatic surgery is undoubtedly owing to the incomparable work of Lister, for until surgery was rendered safe the physiological functions of the pancreas could not be proved experimentally, and now that its functions have been practically agreed upon and its pathology is making rapid headway, it is only by careful antiseptic or aseptic surgery that many of its diseases can be efficiently treated.

In consequence of my interest in abdominal surgery it has fallen to my lot, owing to the kindness of my medical friends and colleagues and the advantages of my having been associated with a large surgical clinic, that I have seen a very considerable number of cases in which the pancreas has been in question, over 100 of which I have personally operated on. It is only natural, therefore, that owing to

these advantages I should have made a number of observations and formed certain views which I am glad to have the opportunity of relating from this chair. My only difficulty is how to deal adequately with the large amount of clinical and pathological material at my disposal, the fact being that I should have found it much easier to give a course of 12 than one of three lectures on this comprehensive subject.

I propose to illustrate my remarks by lantern slides of museum specimens and micro-photographs and by brief references to certain cases of my own and the published records of others. I now take the opportunity of thanking the pathological curators and the pathological committees of the different museums for the facilities they have given me for examining and photographing the specimens under their care and of expressing my indebtedness to Dr. Mackenzie Davidson, Dr. Cammidge, Dr. Worrall, Dr. Forsyth, and Mr. Chadwick for the photographs and lantern slides.

Anatomical Considerations bearing on the Pathology of the Pancreas

I do not propose to enter fully into the anatomy of the pancreas except to point out how a knowledge of its anatomical peculiarities is an essential step towards a comprehension of the etiology of many of its diseases and how the symptoms and signs of pancreatic affections are modified or may even be caused by anatomical variations. It may be likened to a pyramid presenting three flat surfaces, the apex or tail being in contact with the spleen and the base or head being embraced by the concavity of the duodenum. When the head of the pancreas is especially thick it overlaps the sides of the second part of the duodenum and may embrace one-third of its circumference. In rare cases it may actually surround the bowel, as in a case reported in 1862 by Ecker in which the descending portion of the duodenum was surrounded by a ring of pancreatic tissue. This may lead to constriction of the duodenum, thus setting up obstruction which may resemble that due to pyloric stenosis; should the pancreas become enlarged from any cause such as catarrh of the ducts or chronic interstitial pancreatitis, or should it be attacked by new growth.

A case of this kind was described by J. Symington [1] and others have been collected by Shirmer. At least six of these cases have been recorded. The following is a description of Symington's case, which was discovered post mortem in the body of an adult male: "On distending the intestine with air, in order to facilitate the dissection of the head of the pancreas, it was noticed that the upper part of the descending portion did not become dilated like the rest of the intestine, and on examination this was found to be due to its

[1] Journal of Anatomy and Physiology, 1885, vol. xix., p. 292.

being completely surrounded in that situation by pancreatic tissue. Two processes of the pancreas passed from the upper part of the head of the gland towards the right, one in front and the other behind the duodenum. They blended on its outer side so as to form with the head of the gland a ring of pancreas encircling the duodenum. The processes became somewhat narrower as they passed outwards and the portion of the gland on the right side of the duodenum was about half an inch in vertical extent. On dissecting out the ducts of the pancreas nothing unusual was observed in their arrangement. The common bile-duct opened into the duodenum below the seat of the constriction. The circumference of the distended duodenum where it was surrounded by the pancreas was two and a half inches, while above and below that it was more than three times as large."

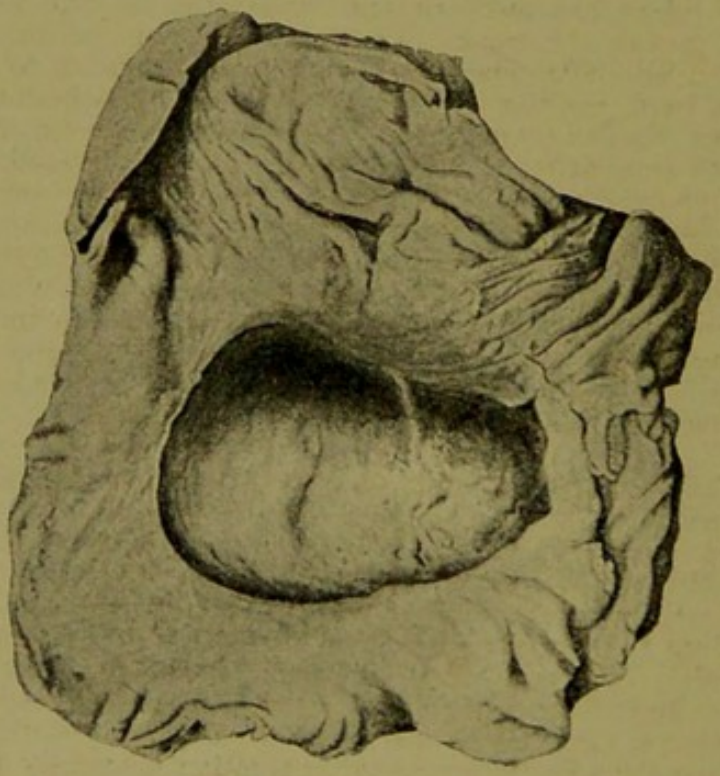
The intimate relation of the head of the pancreas to the duodenum may lead to invasion of the intestine by disease of the gland as I have seen on several occasions and as can be seen in the specimen from St. George's Hospital Museum, 201A, a photograph of which is now thrown on the screen, or to the converse "invasion of the pancreas from cancer of the duodenum," an example of which was lately shown me by Dr. J. F. H. Broadbent, pathologist to St. Mary's Hospital. The duodenum may also be compressed or distorted by a cyst or other tumour of the pancreas or by a pancreatic abscess which may burst into it and so be discharged, as in a case that came under my own observation. In the *Annals of Surgery* for August, 1899, a case is reported by Gallandet in which a cancer of the head of the pancreas so far obliterated the lumen of the duodenum as to call for gastro-enterostomy.

The proximity of the pancreas to the stomach renders it liable to invasion by ulcer or cancer of that organ (Fig. 1) and it is well recognised by surgeons how adhesion to, or invasion of, the pancreas by a cancerous growth of the stomach or pylorus not only adds seriously to the danger of operation but renders a return of the disease extremely probable if removal be attempted. Von Mikulicz's experience is most instructive; of 91 partial gastrectomies without injury to the pancreas the mortality was 27·5 per cent., but in 30 cases of gastrectomy in which the pancreas was injured or partly removed it was 70 per cent. Nevertheless, as part of the operation of gastrectomy, a partial pancreatectomy has been successfully performed on several occasions by Mikulicz, Kocher, and others. In an analysis of 100 cases of cancer of the pylorus Fenwick found the pancreas adherent in six. In 100 cases of cancer of the cardiac end of the stomach the pancreas was adherent on 16 occasions, and in a similar number of cases of cancer of the lesser curvature or posterior wall it was adherent in 19. I have found ulcer invading the pancreas from the stomach, pylorus, or duodenum on several occasions, and in such cases I have as a rule deliberately

left the adhesions intact and contented myself by performing a gastro-enterostomy, which has generally proved curative, as in cases reported in "Diseases of the Stomach and their Surgical Treatment."[2]

I will now show on the screen photographs of two specimens taken from the Hunterian Museum and also two taken from the London Hospital Museum, showing how gastric ulcer may invade the pancreas. The following cases, out of others on which I have operated, illustrate how this condition of chronic ulcer, even when it is associated with indurative pancreatitis, or with abscess, may be cured by the performance of gastro-enterostomy.

FIG. 1.



Chronic ulcer of the posterior wall of the stomach invading the pancreas. (Fenwick, London Hospital Museum.)

CASE 1.—In a man, 35 years of age, a chronic ulcer of the stomach had made its way into the pancreas and had produced a pancreatitis ending in abscess which discharged into the stomach and produced acute gastritis with extremely foul stomach contents and incessant vomiting. The patient was cured by drainage of the stomach into the jejunum by means of a gastro-enterostomy. He now remains well, four years after.

[2] Second edition, published by Baillière, Tindall, and Cox, 1904.

CASE 2.—The patient was a middle-aged man with symptoms of chronic ulcer extending over several years and vomiting of coffee-ground material. On exposure of the stomach no evidence was found to account for the trouble. The stomach was therefore opened when a large ulcer one and a half by three inches was discovered on the posterior wall, eroding the pancreas. A posterior gastro-enterostomy was performed in order to set the stomach at rest and to relieve the hyperchlorhydria, after which recovery was uninterrupted and permanent.

CASE 3.—The following is an example where an ulcer of the pylorus had eroded its way into the substance of the pancreas. The patient was a man, aged 38 years, who had had symptoms for 13 years. Six years after the onset he had had violent hæmatemesis and when seen he was very thin and profoundly weak. An operation was performed on Nov. 15th, 1900, when the pylorus was found to be the site of a hard nodular swelling surrounded by adhesions. On laying the pylorus open an ulcer was discovered in front, which must at some time previously have perforated, but for our present purpose the interest lies in an ulcer which was discovered on the posterior wall, which had ulcerated its way into the substance of the pancreas, so that the tip of the finger could be passed into the excavation. Both ulcers were excised by incision in the longitudinal axis, the wounds being brought together in a transverse direction. Three months later the patient came to report himself as well, having gained 1 stone 11 pounds in weight.

Fixation of the stomach by adhesions, whether the invasion be from the pancreas to the stomach or *vice versâ*, may lead to a train of symptoms when the stomach is distended with food, owing to a limitation of the stomach movements in a downward direction, as well as leading to pain, owing to an interference with normal peristalsis. The anatomical relations of the pancreas to the important structures shown in the specimens and in the diagrams, its fixation, and its great vascularity would render an operation for its complete extirpation extremely difficult, even were it justifiable from a physiological point of view, which is not the case, for its removal in animals is practically universally followed by fatal glycosuria. Note the relations to the aorta and vena cava, to the cœliac plexus, the spleen, the left suprarenal body, the left kidney, the portal vein, the duodenum, the stomach and colon, and even to the uterus during pregnancy. Nevertheless, in the case of disease invading the distal part of the body or the tail of the pancreas the extirpation of that portion may be both justifiable and safe in the case of cystic or solid, benign or malignant growths, as I shall have to mention later when considering neoplasms and cysts.

The relations of the pancreas to the peritoneum are of the

utmost importance from a surgical as well as from a pathological point of view. The retroperitoneal position of the organ is an important fact to notice ; it is well shown in the diagrams and explains not only the course taken by pus in some cases of suppurative pancreatitis but also shows how such a collection may be reached from the loin, especially the left, by an incision in the costo-spinal angle. When I come to speak of abscess of the pancreas the diagrams that I now show will serve to illustrate how in one case I was able to reach a pancreatic abscess from the right loin above the kidney ; how in another I drained the lesser peritoneal sac from the left loin. In another where the pus had passed down behind the peritoneum I succeeded in draining the abscess in the left iliac fossa, while in another the pus travelling upward was found and evacuated as a subdiaphragmatic abscess on the left side. The fact that its anterior surface bulges into the back of the lesser peritoneal sac renders it easy to explain why that large bursa may become invaded in inflammatory affections or in injury, and from its shape it is easy to see why the filled lesser peritoneal sac is not infrequently mistaken for a true cystic tumour of the pancreas, as shown by the diagram I now throw on the screen. Jordan Lloyd clearly demonstrated the nature of this variety of pseudo-cyst years ago.

The operative methods by which we can expose the pancreas may be divided into transperitoneal and retroperitoneal. In the transperitoneal methods one enters through a median or lateral incision in the anterior abdominal wall and then either through the gastro-hepatic or through the great omentum or, after pushing up the omentum and transverse colon, through the mesocolon In each case the omental bursa is opened. Another transperitoneal method of reaching the head of the pancreas is to force one's way along the side of the duodenum, the peritoneal covering of which must first be incised, or the duodenum may be separated from its attachment to the abdominal wall and by lifting the bowel the posterior surface of the head of the pancreas may be exposed. The retroperitoneal methods, by incisions in the lumbar regions, enable one to expose only the head or tail of the organ, and the methods should therefore be employed only when through changes by disease the affected part is pushed farther to one side or is enlarged, as in abscess, cyst, or tumour.

The sharply limited surfaces of the pancreas as well as the site of origin of cysts, whether beginning above or below the transverse mesocolon and to the right or left of the mesentery, cause a considerable variety in the relations of any tumour when developed ; hence the mistakes that are often made in the diagnosis of pancreatic cysts ; these relations I shall give more fully in my last lecture.

The ducts of the pancreas and their variations have important bearings on its pathology as have also the anatomical variations of the common bile-duct. The chief

excretory duct of the pancreas or duct of Wirsung, after passing along the whole length of the pancreas, ends by joining the common bile-duct in a small cavity called the ampulla of Vater, situated within the walls of the second part of the duodenum, and the two ducts discharge their secretion together into the duodenum through the biliary papilla. Besides this chief channel, the pancreas has an accessory duct, the duct of Santorini, which opens through the papilla minor into the duodenum two or three centimetres above the papilla major. These ducts present great varieties in their relations and in their course, and as we shall see when we come to consider the subject of inflammation, the anatomical variations are probably responsible for pancreatitis appearing in some cases of cholelithiasis and not in others. First let us take the common bile-duct, which may conveniently be divided into four portions—*a*, *b*, *c*, *d*. The first two for our present purpose are unimportant, but the varieties of the pancreatic and the intraparietal portions are all important in the relations of jaundice to pancreatitis. The common bile-duct descends alongside the head of the pancreas and comes in contact with the duct of Wirsung, besides which it lies for a short distance before entering the intestinal wall. According to Helly it is completely embraced by the head of the pancreas in 62 per cent. and lies in a deep groove in the gland in the remaining cases. It will be readily seen that if from any cause the head of the pancreas becomes swollen, say from an inflammation set up by the passage of a gall-stone or from a catarrh creeping up Wirsung's duct from the duodenum, the common bile-duct in the former variety will certainly be compressed and jaundice will follow, though in the latter variety where it only lies in a groove in the gland this compression may not take place and the patient may then escape jaundice.

Compression of the common bile-duct by the pancreas I believe accounts for many cases of so-called catarrhal jaundice, both of the acute and chronic variety. If under appropriate treatment the congestion or inflammation subsides the jaundice will rapidly pass off, but if the inflammation continues and chronic interstitial pancreatitis supervenes the jaundice will persist and with it a serious train of symptoms, which I hope to consider in my next lecture. But this relation may act in another way, which can be seen exemplified in one of the specimens on the table and which we can reasonably infer must always occur in certain circumstances. When a gall-stone is passing down the common duct and succeeds in reaching the pancreatic portion of the duct it must, should the pancreas be embracing it, produce serious pressure on the gland which will lead to partial, if not complete, obstruction of the pancreatic ducts, and thus to stagnation of the secretion in the pancreas, which will probably soon become infected, either from the duodenum directly, through the already irritated duct of

Santorini, or by continuity of mucous surfaces through the duct of Wirsung, where it opens into the ampulla of Vater, for it is well known that in many, if not all, cases of common duct cholelithiasis the bile becomes infected and we may reasonably argue from one to the other. Thus this anatomical arrangement is probably responsible for many cases of pancreatitis of greater or less severity.

It may be argued, and, in fact, the argument is used in the text-books, that if one duct of the pancreas be obstructed the other will take up its work, but this is not so in 50 per cent. of cases, as shown by diagrams. These diagrams are the result of the examination of 100 cadavers by Opie who found that in more than half of all individuals the lesser duct is at its orifice obliterated or so contracted that it cannot assume the functions of the larger duct when that is obstructed. The following statistics show the analysis. In 90 specimens the two ducts are united; in ten two wholly independent ducts enter the intestine. 1. Of the ducts in anastomosis. (1) Duct of Wirsung larger in 84: *(a)* duct of Santorini patent in 63; and *(b)* duct of Santorini not patent in 21. (2) Duct of Santorini larger in 6: *(a)* duct of Wirsung patent in 6; and *(b)* duct of Wirsung not patent, 0. 2. Ducts not in anastomosis in 10: *(a)* duct of Wirsung larger in 5; and *(b)* duct of Santorini larger in 5. In 89 per cent. the duct of Wirsung was larger than the duct of Santorini. In 21 per cent. the duct of Santorini was apparently obliterated near its termination. In six cases the duct of Santorini was larger than the duct of Wirsung. In all cases where the duct of Santorini is patent it diminishes in size towards the duodenum. Thus the duct of Santorini cannot be relied on in many cases to supplement the duct of Wirsung, if it be obstructed; moreover, the duct of Wirsung, even if patent and communicating with the duodenum, may itself be compressed by a moderate sized gall-stone passing down the pancreatic portion of the common duct.

The normal termination of the common bile-duct and of Wirsung's duct is into the ampulla of Vater (Fig. 2), which is a conical shell-shaped cavity into the base of which the ducts enter and which Testut describes as from six to seven millimetres in length, but this varies considerably in different individuals from 0 to 11 millimetres, the average according to Opie, in 100 bodies examined, being 3·9 millimetres. In only 30 did the diverticulum exceed 5 millimetres The orifice of the ampulla at the papilla is only 2·5 millimetres in diameter, it being thus narrower than any other part of the common bile-duct. In a proportion of cases the ampulla of Vater is absent, when the terminations of the common and pancreatic ducts are liable to great variations. There may be said to be four types as shown in the diagrams. First, the characteristic type which is described as the ampulla. In the second type the pancreatic duct joins the common duct some little distance from the duodenum, the

ampulla is absent, and the duct opens into the duodenum by a small, flat, oval surface. In the third type the two ducts open into a smaller fossa in the wall of the duodenum, while the caruncle and the ampulla of Vater are both absent. In

FIG. 2.

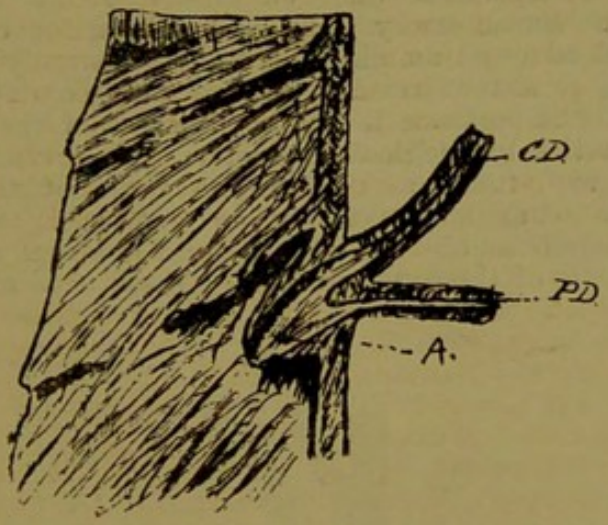
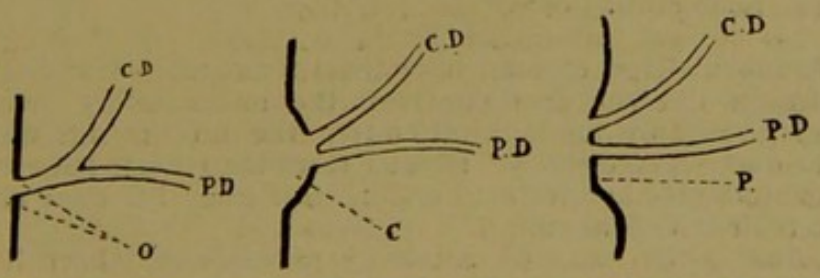


Diagram to show the ampulla of Vater (A), with the ordinary termination of the common bile-duct (CD) and the duct of Wirsung (PD). (Testut.)

the fourth type the caruncle is well developed, the ampulla of Vater being absent, its two ducts opening side by side at the apex of the caruncle (Fig. 3). Among Opie's 100 cases there were 11 examples of this last type. If the diverticulum

FIG. 3.



Three other methods by which the common bile-duct and Wirsung's duct enter the duodenum. CD, Common bile-duct. PD, Pancreatic duct. O, Common orifice. C, Cup-shaped depression in the wall of the duodenum. P, Papilla.

be large it is possible for a small stone to occlude the orifice and yet to leave the two channels entering the diverticulum patent, when bile passing down the common duct may be forced into the duct of Wirsung and bring on acute hæmor-

rhagic pancreatitis (Fig. 4). The diagram which I show illustrates the condition. I shall have more to say on this matter in another lecture when speaking of acute hæmorrhagic pancreatitis.

Accessory pancreatic nodules may be found by the side of, or within the duct of Santorini or in the walls of the stomach, duodenum, jejunum, or ileum and in all such cases a small independent duct empties into the contiguous intestine. An accessory pancreas has been found by J. H. Wright close to the umbilicus, it being apparently connected with the persistent remains of the vitelline duct. These may be of importance in serious diseases of the pancreas itself, as the histological characters and presumably the physiological functions conform to those of the normal pancreas. Thus may possibly be explained some cases where there is an absence of glycosuria in atrophy or extensive disease of the true pancreas. These accessory glands

FIG. 4.

Diagram showing large diverticulum of Vater containing a calculus and illustrating one cause of hæmorrhagic pancreatitis. (Opie.)

tend to undergo chronic interstitial inflammation and other diseases like the true pancreas, the inflammatory process being probably due to infection from the intestine into which the ducts open directly. In some cases these ducts have been found dilated and tortuous and in other cases narrowed close to their intestinal outlet.

Among the cases of accessory pancreas that have been recorded their association with intestinal, especially duodenal, diverticula has been noted. This anomaly is readily explained by the small accessory pancreas being developed in the muscular wall of the gut and producing a weak spot through which the mucous membrane tends to bulge. Among the anomalies of the pancreas, the head or tail may be found separated from the rest of the gland, or a portion of the head may be detached and lie behind the mesenteric vessels, or the groove from the mesenteric

artery may be converted into a channel. In a case on which I operated recently I found a prolongation from the head of the pancreas extending upwards in front of the common bile-duct and the hepatic duct and exerting pressure on both owing to its being inflamed and swollen. A case of congenital ectopia of the head of the pancreas associated with gastroptosis was reported by Cacchini in 1886 and a number of cases have been reported in which the pancreas formed part of the contents of diaphragmatic and umbilical herniæ. In one case the pancreas was contained in the sac of a congenital umbilical hernia. A case of moveable pancreas producing symptoms resembling those of moveable kidney was reported by Dobrzycki in 1878; it was caused by a fall from a height in a man aged 56 years. In one reported case the pancreas was invaginated into the intestinal canal and, strange to say, there has been one case recorded where the pancreas was apparently entirely wanting.

Minute Anatomy.

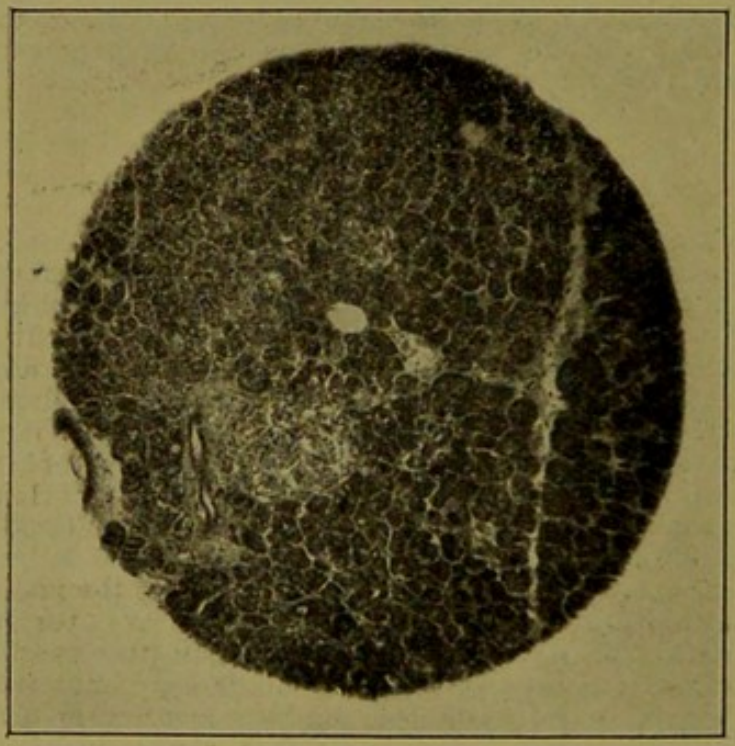
The pancreas is a racemose or acino-tubular gland, the acini being formed of polygonal cells, the ducts connected with the alveoli being lined with flattened epithelium and the larger ducts with long columnar cells. It thus resembles the salivary glands in structure and it appears to have some obscure relation to these glands, as shown by metastasis from the one gland to the other in mumps. Lying in the interalveolar spaces are groups of small, irregular, polygonal cells known as the islands of Langerhans, who described them in 1869 (Fig. 5). These cell masses have an important bearing on metabolism and, as we shall see shortly, on the glycogenic function of the pancreas, but as they are not connected with the ducts in the higher vertebrates they have apparently no relation with the proper secretion of the pancreas, though this is not finally settled. Like the salivary glands the pancreas has a firm texture, the lobes being large. The interacinar connective tissue is, however, of loose texture and readily allows of separation of the lobules, as shown in the beautiful specimen on the table from the Hunterian Museum. We shall see what an important bearing this tissue has when we come to consider interstitial pancreatitis.

Physiological considerations and their bearing on the pathology of the pancreas.—The ferments contained in the pancreatic juice, the proper secretion of the gland, are four: (1) trypsin, a proteolytic, proteid-digesting ferment; (2) amylopsin, an amylolytic or starch-digesting ferment; (3) steapsin, a lipolytic or fat-splitting ferment; and (4) a milk-curdling ferment. Besides these, which pass into the duodenum to perform their functions and which we

shall see afford us certain signs in the excretions if they are absent, there is presumed to be an internal secretion, probably a ferment, secreted by the islands of Langerhans and passing into the blood. This may be termed a glycolytic ferment and when it fails, as occurs in certain inflammatory and other conditions, one of the results is glycosuria.

[Mr. Mayo Robson then recounted the nervous, vascular, and lymphatic supply of the pancreas in their bearing on the pathology of the gland, and continued :—]

FIG. 5.



Micro-photograph of normal pancreas showing islands of Langerhans.

Symptomatology and pathology.—As our knowledge of the functions of the pancreas, both with regard to digestion and metabolism, is becoming fairly well established it would seem probable that any departure from the normal would lead to such considerable disturbance of function that the symptomatology of any of the diseases of the pancreas would be so marked as to make the diagnosis easy. But this is far from being the case for several reasons : First, it is seldom the case that the pancreas is diseased without other organs participating—e.g., the relations between cholelithiasis and pancreatitis ; between gastro-intestinal

catarrh and catarrh of the bile and the pancreatic ducts; between ulcer or tumour of the stomach and extension to the pancreas; between affections of the liver, colon, lymphatic glands, and duodenum and pancreatic disease. Secondly, every function performed by the pancreas may be vicariously taken up by another organ, except the glycogenic function, and that we are not yet certain about. The stomach can digest albumin, the salivary and intestinal glands have the power of digesting starches, and the bile and intestinal secretions can emulsify fats. Thirdly, a considerable portion of the gland may be necrosed and cast off or otherwise disabled and yet the portion remaining may apparently be sufficient to carry on the functions of the pancreas. For instance, in a case of my own, a patient, who is now perfectly well, had necrosis of the pancreas which I removed at operation. As may be seen, a good proportion of his pancreas is on this table. Fourthly, in some cases the true cause of the disease may lie in the pancreas and yet all the symptoms may be caused by implication of another organ. For instance, cancer of the head of the pancreas produces intense jaundice and distension of the gall-bladder, giving the appearance to the uninitiated of disease of the liver or bile-ducts, a symptom to which I drew attention in a paper at the London Clinical Society in 1889. Again, a tumour of the pancreas may compress the intestine and produce intestinal obstruction or lead to pressure on the neighbouring ganglia and cause most violent pain that may be referred to spinal disease, to aneurysm, or to anything but the real cause. Thus it will be seen that very conflicting combinations of symptoms may arise and lead to great difficulty in diagnosis unless we can find some definite signs that will help us to say whether or no the pancreas is participating in the disease in question. I hope to show that this may be possible.

I have decided, before describing any of the special diseases of the pancreas, to consider certain symptoms apart, and as they are intimately associated with pathological questions, it is more convenient to take symptomatology and pathology together. The symptoms may be conveniently classified under (1) digestive symptoms; (2) physical signs; (3) metabolic symptoms; and (4) symptoms artificially produced. 1. Digestive symptoms: (*a*) steatorrhœa or fatty stools; (*b*) azotorrhœa or faulty digestion of albuminous foods; (*c*) sialorrhœa; (*d*) diarrhœa; (*e*) dyspeptic disturbances; (*f*) emaciation; and (*g*) nausea and vomiting. 2. Physical signs: (*a*) presence of swelling or tumour; (*b*) fever; (*c*) pain and tenderness with muscular resistance; (*d*) pressure on adjacent organs; (*e*) hæmorrhage; and (*f*) jaundice; 3. Metabolic symptoms: (*a*) glycosuria; and (*b*) other urinary changes. 4. Special symptoms obtained by artificial means: (*a*) alimentary glycosuria; and (*b*) Sahli's symptoms.

Digestive Symptoms.

Steatorrhœa or fatty stools.—Although Claude Bernard, from experiments which caused the degeneration of the pancreas, came to the conclusion that the pancreatic juice caused the cleavage and emulsification of neutral fats and aided the absorption of fats in the intestine, yet the fact that the cleavage and the emulsification of fats are performed also by the bile, the intestinal juices, and the bacteria in the intestinal canal shows that the symptoms of steatorrhœa cannot be absolutely relied on in pancreatic disease. Abelmann's and Minkowski's observations on dogs are most important and interesting and they have been confirmed by Sandmeyer, Cavazzani, Balli, and Rosenberg. When the pancreas was entirely removed non-emulsified fat was not at all absorbed, and emulsified fat only in small amount (18·5 per cent.) The absorption of fat in the form of milk was much more favourable; on the administration of large amounts 30 per cent., and with smaller amounts 53 per cent., were absorbed. In case of partial extirpation small amounts of emulsified fat were about half used up; after the administration of larger amounts, 70 to 150 grammes, the consumption was not so good (lowest value 30·5 per cent.). Milk was very well absorbed, up to 80 per cent. Administration of pig's pancreas as food facilitated the absorption of fat after the extirpation of the pancreas. Abelmann concludes that all fat with the exception of milk needs unquestionably the influence of the pancreas for its absorption.

In clinical observations as to fatty stools many of the older clinicians relied on naked-eye observations which we now know to be fallacious; for though in some cases where fat is parted with in abundance it is manifest to the patient himself, in other cases a large amount of fat may be passed and only found on chemical investigation of the stools. Kuntzmann in 1820 and Bright in 1833 associated fatty stools with pancreatic disease. To show that the matter is not quite simple, Friedrich Müller found fatty stools in the absence of pancreatic disease, and in a case of obstruction of Wirsung's duct by calculus the fat in the motions was normal, though the last observation does not necessarily carry much weight as Santorini's duct may have been patent. It will be seen that experiments on animals and clinical observations on man do not altogether harmonise. We may, however, derive assistance in the diagnosis of pancreatic disease if we bear in mind the following conclusions:—1. Fat occurs in the stools in three forms: (*a*) as fat droplets; (*b*) as fatty acid crystals; and (*c*) as soap crystals. 2. The capacity for digestion and absorption of fats is limited; if therefore fat be taken in large quantities it is found in the stools. 3. Steatorrhœa occurs in some cases of jaundice, in some cases of enteritis, and in some affections of the pancreas, but in none

of these constantly. 4. When jaundice and interstitial pancreatitis coexist there is a great excess of fat in the stools. 5. The presence of an excess of fat in the motions in the absence of jaundice and diseases of the intestine is suggestive of pancreatic disease. 6. If the pancreatic reaction (to be described later) be found in the urine along with steatorrhœa some affection of the pancreas is almost certain. 7. If azotorrhœa be found along with steatorrhœa it is almost certain that the pancreas is diseased, and if the pancreatic reaction in the urine, diabetes, and an epigastric tumour be present the diagnosis is certain.

The following case is reported by Oser. A woman, aged 39 years, had had diarrhœa since the summer of 1892. The patient became emaciated yet the appetite remained good. Fæcal evacuations appeared regularly every night, were unusually copious, of the consistency of thick porridge and of cadaverous odour, chocolate-coloured, and always abundantly covered with fat rings. On Jan. 11th, 1893, he saw the patient for the first time and found steatorrhœa. The investigations of the stools gave the following result: large in amount and of the consistency of thick porridge; in the sediment were scattered white particles. Microscopic examination showed: (1) very numerous fragments of striated muscle in the main with well-preserved structure; (2) numerous fat acid needles and fat drops; and (3) bacteria and detritus. After drying the stools for several days on the water-bath in order to determine the amount of fat there were obtained 4·6325 grammes of solid substance, in which 2·1265 grammes were fat, representing 45·8 per cent. of the dried residue. The ether extract consisted almost entirely of neutral fat. On Jan. 18th he found in the epigastrium a distinct, hard, round tumour which was diagnosed as carcinoma of the head of the pancreas. In March jaundice developed. At the beginning of April an exploratory laparotomy was undertaken and the diagnosis confirmed. My own experience in a large number of pancreatic cases that have come under my observation has been the almost universal presence of an increased amount of fat in the motions, either in the shape of oily particles or of solid fat or of fatty crystals, which, if normal, should not contain more than 5 per cent.

The characteristic white stools that are often seen in pancreatic disease in the absence of jaundice owe their pale colour entirely to the solidification of the fat when the motions cool, although there may be a normal amount of bile present, and the greasy bulky motions so often seen in pancreatic disease with or without jaundice are often coated with almost pure oil. This is frequently remarked on by patients as floating on the surface of the urine passed at the same time.

In disease of the pancreas, interference with the digestive functions will lead to steatorrhœa and I have often noted it in acute hæmorrhagic, necrotic, and suppurative pancrea-

titis, in calculus of the pancreas, in cancer, and in some cases of cyst, where jaundice had accompanied the cyst formation. I have also seen an almost entire disappearance of the fat in some of these cases after the administration of pankreon tablets, liquor pancreaticus and sandwiches of raw pancreas, as well as a complete disappearance in many cases after surgical treatment.

Azotorrhœa or faulty digestion of albuminous foods.—Fles, so far back as 1864, found in the stools of a diabetic very numerous unchanged bundles of striated muscle fibres which disappeared when the patient had a calf's pancreas administered daily and reappeared when it was omitted. In dogs without a pancreas Abelmann found that albuminous substances were absorbed to the extent of about 44 per cent, and in those where the obliteration was incomplete 54 per cent. was absorbed. When pig's pancreas was given with the meats the amounts absorbed were respectively 74 and 78 per cent. De Benzi, Cavazzini, Sandmeyer, Rosenberg, and others found similar results. The conclusions we may form concerning this symptom are: 1. The digestion of nitrogenous foods is not solely the function of the pancreas. 2. As the normal stools of meat-eaters contain a small proportion of undigested muscle fibres and as in febrile conditions, in disorders of the stomach, and in enteritis they may be found in excess, their presence in the motions is no proof of disease of the pancreas. 3. If azotorrhœa be found along with liporrhœa the presence of pancreatic disease should be suspected. 4. If azotorrhœa and liporrhœa be found associated with diabetes or with tumour of the epigastrium pancreatic disease is extremely probable. 5. If azotorrhœa and liporrhœa be found associated with the pancreatic reaction in the urine pancreatic disease is certainly present.

My experience of azotorrhœa is that it is not so readily noticed as steatorrhœa and my attention is hardly ever drawn to this symptom by the patient, though a careful naked-eye examination of the stools in nearly all diseases where the digestive properties of the pancreas are interfered with has shown the presence of muscular fibres and a microscopic examination has confirmed the observation. This, when taken with other symptoms, is an important point to notice.

Sialorrhœa pancreatica or excessive pancreatic secretion.—This has been referred to by Senn who suggested a causal relation between hyper-secretion of the pancreas and the diarrhœa which is sometimes associated with cysts and degeneration of the pancreas. Actual salivation has been noticed in the case of cysts reported by Ludolf and Battersby. Holzmann and others have reported the same symptoms in the case of pancreatic calculi which they explain as a reflex phenomenon. In the cholera epidemic in

Bern in 1861 a large amount of leucin was found in the intestinal evacuations, suggestive of excessive action of the pancreas. Personally I have not seen salivation in any of my cases of pancreatic disease and I do not consider it of importance from a diagnostic point of view.

Diarrhœa pancreatica and alteration in the stools.—In many cases I have mentioned what one might almost term a characteristic sign of pancreatic disease in the shape of exceedingly bulky, soft, greasy, pale motions, evidently due to the patient's want of digestive power and the passage onwards of the bulk of the food taken. These characteristic motions contain manifest unaltered fat and muscle fibre and are extremely offensive. Patients frequently describe them as diarrhœa, but an examination will show that this is usually an incorrect designation, the motions being bulky and soft and not liquid in consistency. They are due not only to the increased amount of fat and nitrogenous matter passing away undigested but to the bulk of hydro carbonaceous food being parted with, sometimes unaltered. The symptom is a very noticeable one and when it occurs in cases of jaundice it may nearly always be taken as an indication that the pancreatic functions are being interfered with either by an interstitial pancreatitis or some other form of disease. I have more frequently noticed these symptoms in chronic inflammatory conditions than in cancer, the reason being that the appetite is more interfered with by the latter than by the former disease; hence also the symptom is more apt to be noticed in the earlier than the later stage of the disease unless large amounts of milk be given, when the bulk of it may pass away in this form of spurious diarrhœa. Blood may be noticed in the motions occasionally but it is not a regular symptom until the hæmorrhagic tendency occurs later in the disease or unless there happens to be an ulcerating malignant growth present. In some cases constipation exists, the motions being still very bulky and, as a rule, pale. Abscesses of the pancreas and pancreatic cysts have been known to rupture into the intestine and their characteristic contents have been found in the motions. I have personally seen this in one case and in another I have seen the characteristic matter vomited. A necrotic pancreas has been passed through the intestine and cases have been reported by Leichenstern and Minnich in which pancreatic calculi have been passed per anum.

In a paper on the Clinical Significance of Colourless Stools without Jaundice and their Connexion with Disease of the Pancreas, read before the Royal Medical and Chirurgical Society in 1889, Dr. T. J. Walker of Peterborough pointed out the fact that white motions might be indicative of pancreatic disease, although the bile salts are being discharged in the normal way. In discussing this subject a few weeks ago with Sir Lauder Brunton he directed my attention to a lecture in his work, "Disorders of Assimilation,

Digestion, &c.," which was published in the *Edinburgh Medical Journal* for February, 1900, where he had referred to the subject of whiteness of the motions and in which lecture he made the following remarks: "The whiteness is due not to the absence of bile as one would expect but to the presence of undigested fat." He referred to a case which he had seen ten years before. He said: "The motions were as white as arrowroot but were tougher than ordinary formed motions, so much so that instead of breaking into pieces they fell into a very peculiar shape. They looked like a snake coiled up with the head projecting as if ready to strike. An analysis of the fæces was made by Dr. Sidney Martin who found that the liver was doing its work and that the motions contained bile, although in small quantity. Biliverdin was present in an unaltered form, though only an indication of biliary acids could be obtained. The reason of the motions being so white was the fact that the milk was not digested and therefore it appeared in the motions." Sir Lauder Brunton goes on to say that want of change in the fat points to some extent to alteration in the pancreas.

Dyspepsia and alteration of appetite.—I have found dyspeptic disturbances to be constantly associated with affections of the pancreas; they take the form of anorexia, pain and fulness after food, flatulency with offensive eructations, heart-burn, nausea, distaste for fats and for meat. In the case of a woman, aged 28 years, to be referred to later under "Chronic Pancreatitis," a biliary fistula was established in order to relieve the jaundice and by drainage to cure the pancreatitis that was causing pressure on the common bile-duct. All the above-mentioned symptoms were well-marked both before the operation and when the fistula was discharging, and the patient had such a loathing for food that she became extremely emaciated. A cholecystenterostomy was performed and within 12 hours of the restoration of the bile and pancreatic fluid to the duodenum she expressed herself as hungry, a sensation which she said she had not felt for many months; during the month after operation she put on flesh very rapidly and three months later had gained two stones in weight. In several cases where dyspeptic disturbances have been well-marked both in simple and in malignant disease of the pancreas I have found the patients to be markedly relieved of their symptoms and to gain weight by the administration of pankreon tablets or of liquor pancreaticus immediately after meals.

Emaciation.—Ever since pancreatic diseases have been recognised, emaciation has been regarded as a well-known symptom. I have known a patient, a man, aged 59 years, suffering from chronic pancreatitis, to lose eight stones in a little over two years and to regain weight rapidly after a

choledochotomy and the removal of a calculus that was obstructing the pancreatic duct, and I also know of another case in which the patient lost five stones in three months and after operation and relief of the condition to gain three stones in a corresponding period. It is not surprising that emaciation should occur in cancer of the pancreas, in which indeed it is most marked, or in diabetes of pancreatic origin, but it may occur in cystic disease, as in Kuster's case, in which the patient lost two stones five pounds in four months, in chronic pancreatitis, as in the cases I have mentioned, and also in calculous disease.

The disturbance of digestion may afford a sufficient explanation in some cases, but in the malignant and in the atrophic cases the interference with the metabolic function of the pancreas must also be partly responsible for the rapid emaciation. Alone, emaciation would not of course justify a diagnosis of pancreatic disease, but if with rapid loss of flesh, fat and muscle fibres be found in the fæces and pancreatic crystals in the urine the diagnosis of disease of the pancreas may be confidently made.

Nausea and vomiting.—These symptoms are frequently associated with acute pancreatitis and I have seen the vomiting so violent as to suggest acute intestinal obstruction, but in the other forms of pancreatic disease it is not a common symptom and when present it is often due to the neighbouring organs—stomach or duodenum—participating in the trouble or being pressed on. There is nothing specially characteristic in the vomited matter unless, as occurred in one of my cases, extremely offensive pus and altered blood be vomited, when it may point to the rupture of a pancreatic abscess into the stomach. In acute pancreatitis altered blood, so-called "black vomit," is seen at an earlier stage than in any other peritoneal condition.

Physical Signs.

Tumour.—The situation of the pancreas behind the stomach and in front of the spinal column places it in almost the worst possible place for palpation, and in normal circumstances, if the patient be at all stout, it can only be indistinctly felt, but where the patient is thin and in cases of gastroptosis it can readily be defined when the muscles are relaxed and a warm flat hand is applied firmly to the epigastric region. It is commonly stated in text-books that acute and chronic inflammation and even abscess rarely, if ever, cause a perceptible enlargement of the organ. In this view I do not agree, for I have over and over again felt enlargement of the pancreas in these conditions, and I think further experience will show that in many cases a distinct swelling may be felt, which in the acute cases is made up of the swollen pancreas with sur-

rounding effusion of blood and inflammatory fluid, together with matted omentum, in the subacute cases it being due to suppuration and in the chronic cases to a tumefaction of the gland itself. In cancer of the head of the pancreas the only tumour that is ordinarily felt is the swelling caused by an enlarged gall-bladder which can be readily palpated in a considerable proportion of cases. In tumour of the body or tail, as well as in some cases of cancer or sarcoma of the head of the pancreas, palpation readily discovers the swelling and by distending the stomach with gas, either by means of carbonate of soda and tartaric acid given in separate doses or by pumping in air through the stomach tube, the relation of the stomach to the tumour can be readily made out. Resonance on percussion owing to the position of the stomach, unless the stomach is empty, communicated non-expansile pulsation, and very slight movement on deep inspiration are characteristic of swellings of the pancreas. In cystic disease of the pancreas tumour is at first frequently the only symptom, the position, as I shall hope to show, depending on the part of the organ from which the cyst springs. It will thus be seen that the absence of a tumour does not negative serious disease of the pancreas, though the presence of a swelling when taken with other symptoms, especially the urine test, affords valuable evidence of disease.

Fever.—An increase of temperature is, as a rule, associated with acute and subacute pancreatitis, but only rarely with any of the more chronic forms of inflammation, and as a rule it is absent in cystic disease, in calculus, and in new growths. In acute pancreatitis the temperature may be high but in other cases, as in the hæmorrhagic form, it is usually subnormal. In suppurative pancreatitis I have seen the temperature assume a hectic form but in one case coming under my notice it was subnormal and in another it was persistently from 101° F. to 102° or 103° and associated with rigors. In cancer of the head of the pancreas the temperature is generally subnormal. It will thus be seen that fever as a symptom is extremely variable and alone is no guide, though when associated with digestive, metabolic, and certain physical signs it is a symptom of the greatest importance in making a differential diagnosis.

Pain and tenderness.—These symptoms, though important when present, are so variable that even the entire absence of pain and tenderness is no proof that the pancreas is normal. My experience has been that both pain and tenderness are as a rule absent in malignant disease of the head of the pancreas, though, on the other hand, in some exceptional cases of cancer or sarcoma both of the head, body, and tail of the pancreas the pain may be excruciating, this depending either on pressure on, or involvement of, the great sympathetic ganglia, or on pressure on, or invasion of, the

neighbouring viscera, especially the stomach or the duodenum. Small scirrhus tumours are as a rule characterised by the absence of pain while large growths are often marked by constant and extreme agony. In the various forms of pancreatitis pain and tenderness in the epigastrium are, as a rule, well marked and the more acute inflammations are characterised by excessive tenderness on pressure, rigidity of the recti, and pain of an agonising character. In chronic pancreatitis pain and tenderness, though usually present, may be little marked, but in some cases the pain is paroxysmal and severe and epigastric tenderness is well pronounced. Cysts may be quite painless and free from tenderness but in some cases I have seen both pain and tenderness well marked. Even in abscess of the pancreas pain may be absent, as has been reported by Stibler, though in the cases that I have seen pain and tenderness were both pronounced.

Calculus of the pancreas may exist for years undetected and unsuspected without causing any pain but in one case that I operated on the patient pointed to a tender and painful spot on the left of the middle line which she begged of me before operation to examine specially and at which exact spot I found and removed by operation a pancreatic calculus. If a calculus reaches the orifice of the pancreatic duct or gets into the ampulla of Vater severe pain occurs in paroxysms resembling a gall-stone seizure and will then be associated with jaundice. As to the character of the pain it may be continuous or paroxysmal and may be limited to the epigastrium or radiate round either side of the thorax. I have found pain in the back, under the left scapula or between the scapulæ, to be more frequent than pain beneath the right scapula, thus serving to distinguish it from gall-bladder pain. "Cœliac neuralgia" was a term long ago applied to epigastric pain such as is associated with some forms of pancreatic disease and such pain may pass to the cardiac region and resemble angina pectoris, both in its intensity and in its effect on the circulation. It will thus be seen that while pain is a guide to diagnosis it is not pathognomonic of any special disease except acute pancreatitis.

Pressure symptoms.—The presence of ascites owing to involvement of the portal vein is seen at times in the later stages of cancer of the pancreas, when at the same time there may be also pressure on the inferior vena cava and œdema of the lower limbs. When the duodenum is surrounded by the head of the pancreas, an extremely rare condition, or where the gland partly surrounds the bowel, any growth or even inflammation of the head of the pancreas may lead to obstruction to the passage of the stomach contents, to gastric dilatation, and to vomiting, as in pyloric stenosis. Specimens which I will now show on the screen demonstrate how the stomach, the duodenum, and the colon may be pressed on both by cysts and new growths, such as

cancer or sarcoma, and how the viscera contiguous to the pancreas may be seriously displaced, the stomach, for instance, being pushed upwards beneath the diaphragm or downwards below the umbilicus. Distension of the gall-bladder and jaundice are so frequently found in cancer of the head of the pancreas that they have become a well-known sign of the disease and in some cases of chronic pancreatitis the same sequence of events may occur, the presence or absence of this sign being dependent on the relation of the common duct to the head of the pancreas. Pressure on, or involvement of, the solar plexus may give rise to agonising pain. In some cases the hepatic duct may be pressed on when the common duct is free, as in a case I saw a few months ago where there was jaundice without distended gall-bladder owing to pancreatitis involving a prolongation of the gland upwards towards the liver. The pressure of a pancreatic cyst passing upwards to the under surface of the diaphragm may cause dyspnœa from interference with the functions of the heart or the lungs, and in case of inflammatory effusion in the lesser peritoneal sac there may be pressure on the pericardium through the diaphragm leading to distressing cardiac symptoms.

Hæmorrhage.—Besides the local hæmorrhage that may be known as pancreatic apoplexy and the form known as hæmorrhagic pancreatitis, there is in many pancreatic affections a tendency to general hæmorrhage from wounds or from mucous surfaces and to petechial hæmorrhage in the skin or to more extensive bleeding in the subcutaneous tissues. It is well recognised that a hæmorrhagic condition coexists with cancer of the head of the pancreas. Some years ago I thought this to be altogether dependent on the cholæmia, until increased experience in operating on deeply jaundiced patients has taught me that there is much less danger of serious hæmorrhage in patients jaundiced from gall-stones than in those where the jaundice depends on pancreatic disease. This tendency may be due to an altered condition of the blood both in its tissue elements and chemically. In the cases where the blood has been examined for me a very marked diminution in the number of blood plates has been found and the coagulating period has always been seriously delayed.

As for the chemical changes, it is well known that a diminution in the lime salts leads to a tendency to hæmorrhage, and as we have found that there is in nearly every case of pancreatitis a profuse excretion of lime in the shape of oxalates this gives another explanation and also explains the beneficial effects resulting from the administration of calcium chloride. In urine containing bile, calcium oxalate crystals are not generally found microscopically because the bile takes up the lime salts, but after the jaundice has been relieved by operation an examination of the urine will, as a rule, show oxalate crystals so long as any pancreatic trouble

continues. In several cases of cancer of the pancreas on which I have operated the bleeding has been the immediate cause of death. In one case sent to me in 1888 by Professor T. Clifford Allbutt, a cholecystotomy was followed by persistent oozing of blood from the interior of the gall-bladder and from the stitch punctures, which resisted all the then known remedial measures in the way of styptics, pressure, transfusion, &c., and proved fatal on the ninth day. In another case of cancer of the head of the pancreas, sent to me by Dr. W. Scatterty of Keighley, a cerebral hæmorrhage on the tenth day produced a fatal result. In neither of these cases was there any peritonitis or other cause than the hæmorrhage to account for death. Now in another patient equally deeply jaundiced whom I saw with Dr. T. Churton in 1889, but where the disease was dependent on cancer of the common bile-duct above the entrance of the pancreatic duct, there was no hæmorrhage, although the patient survived several weeks and died from exhaustion due to the disease and to the suppurative cholangitis accompanying it. I could give many similar comparisons showing the difference between the behaviour of the blood in the two classes of cases.

Before operating on these cases I now always administer calcium chloride in from 30 to 60 grain doses thrice daily for from 24 to 48 hours previously to operation and by enema in 60 grain doses thrice daily for 48 hours afterwards ; this is usually successful in correcting the hæmorrhagic tendency. The following cases show its efficiency subsequently to operation.

A woman, aged 38 years, was suffering from deep jaundice associated with gall-stones in the common duct and chronic pancreatitis. There was no bleeding at the time of the performance of duodeno-choledochotomy as calcium chloride had been administered for several days before operation. The drug was inadvertently omitted after operation and on the third day violent hæmorrhage occurred which was arrested by opening up the wound and packing with gauze and at the same time giving calcium chloride in 60 grain doses twice and afterwards in 30-grain doses for several days. No recurrence of bleeding occurred and a good recovery was made.

In the case of a male patient, aged 42 years, suffering from cirrhosis of the liver, gall-stones in the common duct, and chronic pancreatitis, no bleeding occurred at operation owing to the saturation of the blood with lime salts ; in consequence of this they were left off the second day after operation. Bleeding occurred very freely on the sixth day in the form of general oozing which was permanently arrested by the free administration of calcium chloride, after which recovery occurred.

In a case of suppurative catarrh of the pancreas in a gentleman, aged 65 years, the same freedom from hæmorrhage was found at operation after the administration for

some days of chloride of lime which could not be given as the rectum was intolerant of injection. On the seventh day free bleeding occurred which was arrested by giving 30 grains of calcium chloride every two hours.

Other cases could be given were it desirable to show the remarkable effect of saturating the blood with lime in order to prevent or to arrest bleeding in these cases. In operating on these cases of pancreatic trouble, especially if associated with jaundice, it is important carefully to ligature all vessels and not to trust to simple forci-pressure.

Jaundice.—The now well-recognised relation between pancreatic and gall-stone trouble would lead one to suspect that jaundice would be a frequent accompaniment of pancreatic disease but this symptom is by no means constant. The relation of the common duct to Wirsung's duct and to the head of the pancreas is generally the determining factor of deep jaundice, though in nearly all inflammatory affections an extension of the inflammation takes place and sets up a more or less severe catarrhal jaundice. If, as is the case in 38 per cent. of bodies (Helly), the common duct passes behind the head of the pancreas either an acute or chronic pancreatitis, or even a cancer of the pancreas, may run its course without the appearance of jaundice, but if the common duct lies in a deep groove or is imbedded in the head of the pancreas, as occurs in 62 per cent. of cases, either pancreatitis or growth of the head of the pancreas must necessarily compress the bile-duct and lead to jaundice of greater or less intensity. It may, perhaps, only be a coincidence, but Dr. Cammidge tells me that in all the specimens of urine that he has examined for me from patients suffering from pancreatitis, bile has been found in just over 60 per cent. If common duct cholelithiasis be the cause of pancreatitis jaundice will, of course, be present. Deep jaundice associated with distended gall-bladder is significant of cancer of the head of the pancreas, whereas if the cause of the jaundice be gall-stones in the common duct the gall-bladder is nearly always contracted and not capable of being felt.

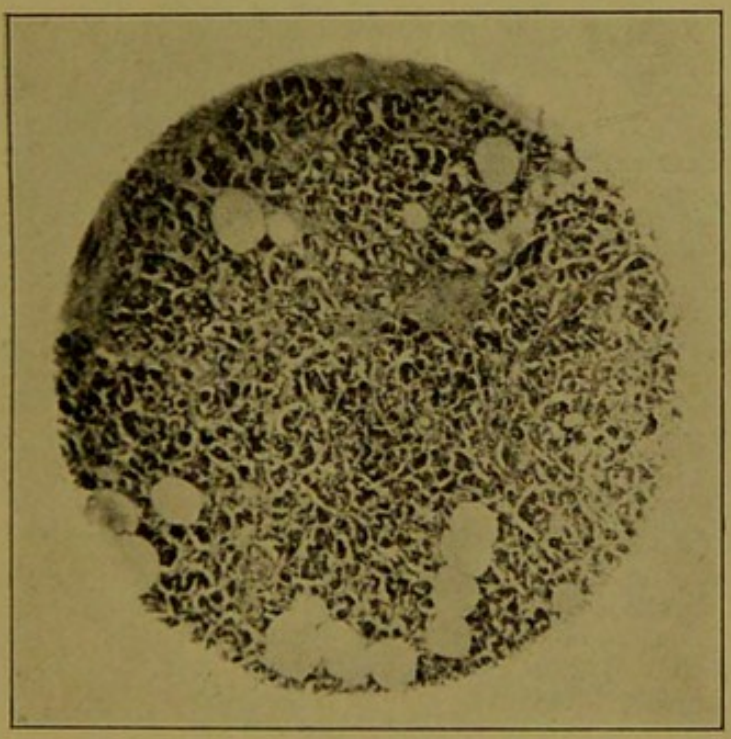
Metabolic Symptoms.

Diabetes and glycosuria as symptoms of disease of the pancreas.—In speaking of the functions of the pancreas mention was made of an internal secretion which recent researches have apparently traced to the islands of Langerhans. It is believed that the absence of this secretion owing to the destruction of these islands leads to diabetes. The earliest observations connecting the pancreas with diabetes was by Cowley in 1788 in the *London Medical Journal*. The patient was an alcoholic, 34 years of age, and a post-mortem examination showed the pancreas to contain

numerous calculi. In 1821 Chopart reported the case of a diabetic, aged 19 years, who also had jaundice and steatorrhœa. A necropsy revealed the head of the pancreas to be forming a hard, nodular tumour and the body to be atrophied, the common bile-duct being obstructed.

The classical experiments of von Mering and Minkowski, who showed that the total removal of the pancreas in dogs regularly resulted in diabetes, and the important discovery of Opie that hyaline degeneration of the islands of Langerhans was present in a girl, aged 17 years, who had died from diabetes, followed by other observations that diabetes is only present when the islands of Langerhans are involved

FIG. 6.



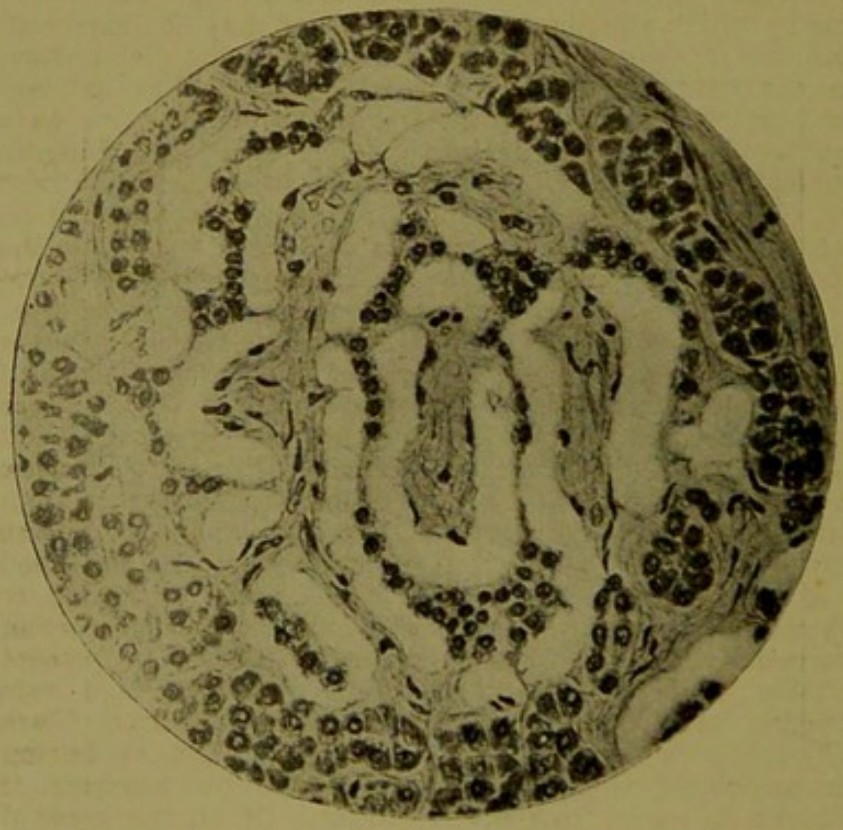
Micro-photograph showing chronic interstitial pancreatitis of interacinar variety. From a case of diabetes.

as in the interacinar type of chronic interstitial pancreatitis, have now apparently established the fact that in diseases of these islands we have the origin of pancreatic diabetes. This explains many of the anomalies that were previously incapable of explanation and renders it quite easy to see why glycosuria should be present in some diseases of the pancreas and not in others. For instance, in chronic interstitial pancreatitis of the interlobular type there is no glycosuria, and the lantern slides which I now show, kindly made for me by Dr. P. J. Cammidge, demonstrate that in this condition the islands of Langerhans are quite free from disease (Fig. 6). In the next slide, one of chronic inter-

(Fig 6)

stitial pancreatitis of the interacinar form, it will be seen that the islands of Langerhans are involved and in this case diabetes was found and led to death. The next slide is from a case of general cirrhosis of the pancreas with diabetes. Here it will be noticed that the atrophic process has involved the islands. The next slide shows hyaline degeneration of the islands of Langerhans where diabetes was present. This slide is copied by permission from Dr. Opie's monograph of a specimen which he was good enough to demonstrate to me in the Johns Hopkins Laboratory

FIG 7.



Micro-photograph showing hyaline degeneration of the islands of Langerhans. (Opie.)

(Fig. 7). In extensive malignant disease the whole gland may be destroyed and then diabetes will be present, as in the photograph of a specimen which I show on the screen.

In cases of cancer part of the gland may remain unaffected—glycosuria will not then be present, and the same applies to cysts and other tumours, as well as to interstitial pancreatitis, which may be limited to one part of the gland. Out of a large number of cases of disease of the pancreas that I have seen I have only occasionally found glycosuria present, and in such cases, if well marked, I have not

recommended operation, though I am not prepared to say that benefit might not arise by drainage in some cases of interacinar pancreatitis if caught early. As yet, however, I have no experience to bring forward to prove this.

It will thus be seen that glycosuria is not common and cannot be relied on as a diagnostic symptom in diseases of the pancreas, but when it exists along with other signs it is extremely serious and, in fact, as a rule indicates an incurable condition.

Other changes in the urine.—In consequence of the indefinite character of the symptoms in various diseases of the pancreas a want has been long felt for some distinctive signs by which affections of the pancreas may be diagnosed. From the important metabolic functions of the gland attention was naturally given to the urine and in turn indicanuria, maltosuria, pentosuria, lipuria, and glycosuria have been advanced as of diagnostic importance in pancreatic troubles. With regard to indicanuria Gerhardi in 1886 from observations on man, and Piseni from experiments on dogs, thought that changes in the amount of indican in the urine afforded diagnostic data in pancreatic diseases, but Katz and De Renzi's experiments on animals disproved this, and many observations on my own cases and those by other clinical observers enable us to say that the amount of indican in the urine is no guide to the presence or absence of disease of the pancreas. Le Nobel and von Ackeren separately found maltose or some allied sugar in two cases of pancreatic disease but in a large number of observations on the urine from patients suffering from different forms of pancreatic disease it has not been found. This, therefore, cannot be relied on as an important symptom. Pentosuria, according to Salkowski, is of greater diagnostic importance, but further observations showed it to be inconstant and to be present in other than pancreatic conditions. Lipuria is a rare condition and although described by Mr. Alfred Clark in THE LANCET of August 16th, 1851, p. 152, as having been associated with a case of cancer of the pancreas, it is known to result from divers causes. Of all the cases of pancreatic disease that I have seen I have only once found lipuria as a symptom and that was in a case of chronic pancreatitis in a lady, aged 44 years. It was associated with liporrhœa, azotorrhœa, bulky stools, and with a well-marked pancreatic reaction in the urine, the cause being apparently an extension from duodenal catarrh. The abdomen was opened and a swelling of the pancreas was discovered with a number of adhesions surrounding it, but no gall-stones were found. Drainage of the bile-ducts by a simple cholecystotomy completely cured the pancreatic condition, and when the urine was examined a year later there was an entire absence of the pancreatic reaction. Lipuria is difficult to explain and in the case I have mentioned it was not associated with any signs of diseased kidney. As it occurs so

seldom it cannot be relied on as an important point in affections of the pancreas.

As showing how little importance has been attached to urinary analysis as an aid to diagnosis Oser says: "In brief, the condition of the urine in diseases of the pancreas has no special peculiarities." I hope to be able to prove that this statement will in future need modifying. As the result of a large number of observations on a considerable number of cases I hope, in conjunction with Dr. P. J. Cammidge, to be able to adduce proofs that a certain reaction may be obtained from the urine in the greater number of, if not in all, diseases of the pancreas, which affords considerable help in diagnosis, but further than this, our experience leads us to believe that it may be possible to distinguish between acute and chronic inflammation and between simple and malignant disease. The presence of glycosuria does not prevent the pancreatic reaction being obtained but the sugar must first be removed by fermentation. In this way, therefore, it may be possible to make the diagnosis of pancreatic diabetes. At first when the method was crude and incomplete and our experience in its employment was small, the conclusions, though helpful, were not so certain that one dare venture to assert more than a hope that it would be a help in diagnosis, and this I announced in an address before the American Surgical Association in Baltimore in May, 1901. From that time onwards the test has been applied in every case that has come under my care where the pancreas was suspected and in a large number of control cases where there was no suspicion of pancreatic disease. The control experiments led to the discovery that certain allied crystals were obtained in some other diseased conditions, such as cancer and chronic inflammation, where marked tissue changes were taking place, but fortunately the difference in the shape of the crystals and the increased time they took to dissolve in sulphuric acid and other tests enabled them to be differentiated. There is still a great deal of work to be done on the subject which may have other important issues but we think the time has come when a further announcement should be made so that the utility of the method may be tested by other observers. Of the manner in which these crystals were found, of the method of their preparation, and of their significance, my friend Dr. Cammidge will have much more to say in his Arris and Gale lecture; of their diagnostic importance I will now give my experience.

To give a list of all the cases that we have observed together would be easy, since all have been accurately recorded, but in this lecture it will be more useful if I group the cases. Although I have operated on over 100 patients for pancreatic disease of one kind or another, in my earlier cases the urinary pancreatic reaction was unknown and it is only during 1900 and since that we have been employing the test systematically, but during that time

several hundred analyses have been made and the diagnoses have been confirmed by operation in 56 and by necropsy in other cases.

In a considerable number of cases of cancer of the head of the pancreas with jaundice the test has been applied and either confirmed the diagnosis made from the clinical signs or proved the presence of malignant disease in the face of irregular symptoms which rendered the diagnosis doubtful, so that one has been able to advise non-operative treatment with confidence instead of having to recommend an exploratory operation which could do no real good. One of the most marked cases of this kind occurred only a month ago where no less than six medical men of eminence had advised operation in a woman, aged 48 years, in consequence of the general condition of the patient being better than one might have expected after jaundice had existed for five months had the cause depended on cancer. An examination of the urine revealed such a marked pancreatic reaction pointing to cancer of the head of the pancreas that I had not the slightest hesitation in advising non-operative treatment. This, however, did not satisfy the patient who, with the support of her medical advisers, wished to have an exploratory operation done. On opening the abdomen I found, as suspected, a very hard, nodular growth of the head of the pancreas, undoubtedly malignant. The absence of adhesions and the presence of a distended gall-bladder afforded clear evidence that gall-stones had never been present in the case.

In several cases suspected from the clinical signs and symptoms to be cancer, the disease has been proved by this test to be inflammatory and curative operations have been performed—for instance, in the case of a man, aged 51 years, seen in August, 1901, suffering from deep jaundice with great emaciation, the liver being enlarged and there being very slight tenderness. Although he had had rigors and other signs of infective cholangitis there was no history of pain beyond one slight attack of colic that was very indefinite. Cancer of the pancreas had been diagnosed and his case was believed to be hopeless. Before refusing to operate an analysis of the urine was made and a well-marked pancreatic reaction was found, pointing to inflammation and not to malignant disease. An operation was therefore undertaken on Sept. 29th, 1901, when the head of the pancreas was found to be markedly enlarged, the swelling extending well into the body of the pancreas, and five calculi were found in the lower end of the common bile-duct obstructing the pancreatic ducts. These were removed and the common duct was drained. The patient made a good recovery and in two months had gained one stone three pounds. A report received last year was to the effect that he was in perfect health.

In another case that I saw in October, 1903, a patient, aged 57 years, who had resided in India for years, where he

had suffered from fever which had left him with a greatly enlarged spleen, gave a history of loss of flesh for some months preceding the jaundice which came on in July, 1903. The patient himself said that he had had no pain but his medical man said that there had been an attack of pain preceding the jaundice. Loss of flesh was well marked and the patient was so ill, there being slight œdema of the feet and enlargement of the spleen to below the umbilicus and of the liver to the umbilical level, that I had very little doubt of the case being malignant. A consulting physician who saw him before me found ague organisms in the blood and after watching him for a time considered the case unsuitable for operation. Before deciding finally an examination of the urine was made, when a well-marked pancreatic reaction was found pointing to inflammation and not to malignant disease and an analysis of the fæces showed steatorrhœa and azotorrhœa. An operation was therefore performed on Nov. 5th, 1903, when the liver was found to be enlarged, dark, and granular, as if in the first stage of cirrhosis, and after separating numerous adhesions a rounded gall-stone of the size of a small walnut was discovered in the common duct, where it was pressing on the pancreas. The pancreas was considerably enlarged but it did not embrace the common duct. After the removal of the calculus a probe passed quite easily into the duodenum and as the duct was not embracing the pancreas I did not consider it necessary to drain it. Recovery was completely satisfactory and the patient is now well.

In one case diagnosed by an eminent physician as cancer of the head of the pancreas, that of a man, aged 65 years, no pancreatic reaction was obtained and on the strength of this test an exploratory operation was performed, when the pancreas was found to be healthy and a gall-stone was removed from the upper part of the common duct, with the result that the patient is now well. In two cases of malignant disease, "cancer of the head of the pancreas and cancer of the biliary papilla" with deep jaundice, the test showed the presence of inflammation of the pancreas and exploratory operations were in consequence undertaken, but the error was not in the test but in our reading of it. The fact is that in many cases of cancer of the pancreas a catarrhal inflammation ensues as a secondary symptom, just as a catarrhal jaundice frequently supervenes in cancer of the liver. These cases led to modifications in the process which have prevented further mistakes of the same nature. In two cases of pancreatic cyst where the diagnosis was doubtful the test showed the presence of pancreatitis which is usually present in the interstitial form in these cases. In three cases of acute pancreatitis the test answered perfectly in confirming the diagnosis. In two cases of suppurative catarrh, associated with fever and jaundice, the presence of pancreatic inflammation was proved by an abundant crop of crystals. In a number of cases of simple catarrhal and of

interstitial pancreatitis, both with and without gall-stones, the pancreatic reaction has enabled a diagnosis to be made and active treatment to be applied. In two cases of abscess of the pancreas the reaction was well marked and proved to be correct at the operation and in two cases of pancreatic calculi the reaction proved the presence of interstitial inflammation. Almost equally important have been some of the negative reactions in chronic biliary catarrh, in cirrhosis of the liver, and in tumours supposed to be pancreatic from their situation behind the stomach. From a pathological and clinical point of view the observations made on the urine of patients long after being operated on for pancreatic inflammation and supposed to be quite well are most instructive and will be mentioned in my next lecture.

Special Symptoms obtained by Artificial Means.

Alimentary glycosuria.—Minkowski has shown that if only a part of the pancreas be removed diabetes does not result but the ability of the organ to perform its normal function on carbohydrate metabolism is impaired ; for if to animals in which the pancreas has been partially removed sugar be given in large quantities temporary glycosuria results. Wille has observed the symptom in man in association with disease of the pancreas. He adopted the test of giving from two to three ounces of sugar before breakfast to 800 patients, the urine being tested before the sugar was taken and later at intervals of two hours. When the test was positive glycosuria usually occurred at the end of two hours. Of 15 patients exhibiting alimentary glycosuria who subsequently came to necropsy, ten presented grave pancreatic disease, chronic interstitial pancreatitis or cancer. Although this symptom may occur under other conditions, as exophthalmic goitre or chronic alcoholism, its presence has considerable value as an aid to diagnosis.

Sahli's symptom.—If iodoform be inclosed in a gelatin capsule, hardened in formalin, and given by the mouth it is almost unaffected by gastric digestion but is readily dissolved by the pancreatic secretion. If pancreatic digestion is normal, iodine should appear in the urine in from four to eight hours. The absence of the reaction or its delayed appearance, if the motor function of the stomach be normal, indicates, according to Sahli, an impairment of pancreatic digestion.

Grouping of Symptoms.

With such a number of symptoms and signs as those I have related it is a mystery to me how the idea has gained so firm a hold that pancreatic diseases are, as a rule, undiagnosable. For instance, Opie only last year wrote :

"Disease of the pancreas is rarely recognised during life," which is a reproach that I hope will in future have no justification. Although in any single case we may not have all the symptoms and signs that I have mentioned, yet in no case ought we to fail to find digestive or metabolic or physical signs if disease of the pancreas be present. Different diseases of the pancreas it will be seen, as one would expect, present very various grouping of symptoms, but in nearly every, if not in every, case since Dr. Cammidge and I have been working together at the subject we have found most valuable help from the pancreatic reaction. Although we must not yet say that this sign is absolutely pathognomonic, yet it is safe to make the assertion that if the test be skilfully carried out it affords most valuable positive or negative evidence when taken with other symptoms, in not only establishing the presence or absence of some disease of the pancreas but in assisting in the differentiation of simple from malignant disease, a most important matter when surgical treatment is in question.

The two pathological conditions of fat necrosis and hæmorrhage are full of interest and to do full justice to them would occupy all the time at my disposal. Although they are intimately related to pancreatitis it is desirable that they should have separate consideration.

Fat necrosis.—Fat necrosis was first described by Balser in 1882, but has since been investigated by Langerhans, Hildebrand, Dettmer, Milisch, Williams, Flexner, Opie, and many others. Experiments by Opie, who ligatured the pancreatic ducts in the cat, go to show that widespread fat necrosis may be expected to follow the operation very rapidly. A photograph of this was shown on the screen and at the same time a microphotograph of fat necrosis.

By fat necrosis is understood a disintegration or necrosis of the living fatty tissues in the neighbourhood of the pancreas or in small spots diffused widely over the peritoneal cavity or even in the pericardium or pleura or subcutaneous fat. It is associated with a splitting up of the fat into fatty acids and glycerine; the latter is absorbed but the acids being insoluble remain in the cells either as crystals, or uniting with the calcium salts of the blood they form yellowish-white patches of various sizes. Fat necrosis is commonly found in association with pancreatitis and other diseases of the pancreas and the relation between the two conditions has given rise to much speculation. As the result, however, of clinical observation and experimental evidence we may now accept the fact that it is always the result of the penetration of the fat-splitting ferment of the pancreas first into the tissues in the neighbourhood of the gland and when more extensive to the diffusion of the ferment either through continuity of tissue or by means of the lymphatics. It is important to remember that fat necrosis may be present

and yet not be visible to the naked eye, although it may be discovered by a method suggested by Bender, the application of a solution of acetate of copper to the tissues. The recognition of fat necrosis by the surgeon who opens the abdomen to relieve symptoms associated with peritonitis in the upper abdomen is of the utmost importance, as it indicates a grave lesion of the pancreas, probably hæmorrhagic, gangrenous, or suppurative pancreatitis. It is said not to occur generally with suppurative inflammation, but in a case to be related shortly I found a most extensive fat necrosis in association with subdiaphragmatic abscess of pancreatic origin. It has also been said that the presence of extensive fat necrosis is a fatal sign, but a case of my own disproves this, as a patient under my care made a complete recovery after an operation undertaken for acute pancreatitis in which the fat necrosis was well marked and diffuse. Truhart has also been able to collect ten cases in which the diagnosis was made and yet an immediately fatal issue did not occur. As the ferment causing fat necrosis may be excreted by the kidneys it would form an important diagnostic sign if it could be found in the urine, but this has not yet been determined, although in one case of acute hæmorrhagic pancreatitis Opie obtained a suggestive reaction by means of ethyl butyrate, as suggested by Castle and Loevenhart.

Hæmorrhage.—Hæmorrhage in its various forms is often held up as one of the great mysteries of pancreatic affections and the free use of the term "hæmorrhagic pancreatitis" in ordinary acute inflammation, even where there has been really no hæmorrhage and in others no more bleeding into the tissues than takes place frequently in acute inflammation in other organs where the tissues are soft, has led to an accentuation of the mystery. It is well known that local hæmorrhage into the pancreas may occur apart from injury and apart from any general hæmorrhagic tendency and that, although it may be recovered from, as shown by the remains of extravasated blood in the gland in persons dying from other diseases, yet such spontaneous hæmorrhage may lead to death from collapse either immediately or after some hours. Curiously this may occur in persons apparently in good health and without any premonitory signs on which a diagnosis can be based, the only symptom at the time being those of collapse, with dyspnœa and feeble pulse. In this way, severe pancreatic hæmorrhage apart from pancreatitis, forms a disease in itself.

Causes of Pancreatic Hæmorrhage.

1. Vascular disease, such as atheroma and fatty degeneration, or alcoholic or syphilitic arteritis. The following case under my care appears to be one in point. An aged subject,

with markedly atheromatous vessels, had a simple drainage operation performed for the relief of jaundice due to cancer of the head of the pancreas. Death occurred on the third day, almost suddenly from collapse, and at the necropsy there was found extensive effusion of blood away from the site of operation and behind the peritoneum, extending into the loins around the kidney and into the cellular tissues beneath the diaphragm, the blood being in sufficient quantity to account for death. The bleeding had manifestly arisen from the pancreas but there was no gross vascular lesion found to account for it.

The following case under the care of Draper (one of sudden death from pancreatic hæmorrhage) is reported by Oser. A woman, aged 44 years, was found dead in bed. She drank alcoholic liquors but was rarely intoxicated and in the evening before was perfectly well. In the morning she complained of headache, returned to bed, and later was found dead. At the necropsy the pancreas was seen to be infiltrated with blood throughout its whole extent; there were also a moderate amount of blood in the retroperitonaal tissue and eight ounces of reddish fluid in the peritoneal cavity.

2. Injury may be the cause. The tissues of the pancreas are comparatively soft and easily bruised, so that although anatomically it is placed in the most protected position, yet a slight injury takes more effect on it than on many other firmer organs and there is ample experience of pancreatitis resulting from blows in the epigastrium apparently trifling in character as in a case that I saw several years ago. A butler slipped and fell forward against a knifeboard projecting from the end of the table at which he was working. The blow was comparatively slight and the man did not even fall to the ground. Pancreatitis followed on what was at the beginning probably a mere bruising of the pancreas but which was followed by slight bleeding into the gland and this effusion becoming infected acute hæmorrhagic pancreatitis resulted. An exploration for the cause of the peritonitis resulted in the discovery of a large collection of highly blood-stained fluid in the lesser peritoneal sac, some of which had burst through a small laceration in the omentum into the greater peritoneal sac. There was general peritonitis present at the time of operation and though drainage was freely adopted both from the front and back the patient did not survive many hours. Probably slight injury to the pancreas may occur in abdominal operations for gall-stones in the common duct when it is sometimes necessary to manipulate the head of the pancreas rather freely. Though I have not personally seen such an occurrence, such a case has been related recently. The photographs now thrown on the screen are examples of hæmorrhagic pancreatitis and the specimens from St. Bartholomew's Hospital Museum on the table show traumatic hæmorrhage and hæmorrhagic pancreatitis respectively.

3. Fatty degeneration of the gland cells and deposit of fat in the pancreas, the result of alcoholism or of general adiposity, may lead to want of support of the blood vessels which are no longer able to withstand the blood pressure. This may account for hæmorrhagic pancreatitis so often occurring in fat and flabby individuals. I show on the screen a case of fatty pancreas from the Hunterian Museum.

4. Fat necrosis in the gland or its vicinity has been suggested by Balser who related several cases in support of his views.

5. Disintegration of neoplasms, such as cancer or sarcoma, may be the cause of extensive hæmorrhage.

6. Hæmorrhage from embolism of a pancreatic artery is reported by Mollière.

7. Other causes, such as heart disease, lung disease, cirrhosis of liver, hæmorrhagic diathesis, scurvy, purpura, the exanthemata, phosphorous poisoning, &c., may all give rise to pancreatic hæmorrhage.

8. Pancreatitis may undoubtedly lead to hæmorrhage and in considering acute pancreatitis I shall refer to it again, but it seems highly probable that an effusion of blood into the pancreas from one of the before-mentioned causes should more frequently be the cause rather than the effect of pancreatitis owing to disruption of the secreting tissue, escape of the proper secretion of the gland, fat necrosis, and invasion of the effusion by organisms either through the ducts or in some other way. Large pancreatic hæmorrhages are of great interest clinically and are probably more common than is usually thought; they may occur into the substance of the gland and disintegrate it, or on to the surface and lead to extensive effusion either beneath the peritoneum or into the lesser sac, as in the case which I have related.

Symptoms.—A great variety of symptoms may occur, from mere attacks of colic in the epigastric region, soon passing off, to violent and persistent pain followed by collapse and rapid death within a short time, or if recovery from the first seizure should occur the attacks may be repeated and ultimately symptoms of acute pancreatitis may supervene. The site of the pain may be præcordial or dorsal but it is usually epigastric and is often accompanied by vomiting. The abdomen soon becomes distended and tympanitic and if inflammation occurs fever of an irregular type may supervene, or if the disease assumes a rapid ultra-acute form the temperature may be subnormal throughout. At first the diagnosis will be obscure but with the onset of pancreatitis some of the symptoms which I have related will be found and an examination of the urine for the pancreatic reaction will afford valuable help.

Treatment.—In the very acute cases, where death rapidly occurs, even if the diagnosis could be made specific treatment would probably be useless, but if the diagnosis could be effected before a fatal result had occurred, abdominal section and gauze packing would seem to be indicated. In the later stages the treatment is that of acute pancreatitis and in this case a diagnosis can be made both from the symptoms and physical signs as well as from the discovery of the pancreatic reaction in the urine.

LECTURE II.

Delivered on March 9th.

Inflammatory Affections of the Pancreas.

Mr. President and Gentlemen,—If we were to base our opinions on the post-mortem records of the past, inflammatory affections of the pancreas would have to be considered among the rarest of diseases, but recent clinical observations and operative experience show that such conclusions would be far from accurate, and I think I shall be able to demonstrate both from my own and from the experience of others that inflammatory affections of the pancreas or its ducts are very much more common than is generally supposed.

Classification.—Pancreatic inflammations may be catarrhal, in which the inflammatory trouble is in the ducts, or parenchymatous, in which the substance of the pancreas is involved. The former resemble the different forms of cholangitis with which, indeed, they are frequently associated, the latter bear more resemblance to inflammatory affections of the appendix, "suppurative and gangrenous appendicitis." The following shows the classification at a glance.

Catarrhal inflammations.—(*a*) Simple catarrh, acute and chronic; and (*b*) suppurative catarrh.

Parenchymatous inflammations.—Acute: (*a*) Hæmorrhagic pancreatitis: (1) ultra-acute, in which the hæmorrhage precedes the inflammation, the bleeding being profuse and both within and outside the gland; and (2) acute, in which inflammation precedes the hæmorrhage which is less profuse and is distributed in patches through the gland. (*b*) Gangrenous pancreatitis. (*c*) Suppurative pancreatitis (diffuse suppuration). Subacute: Abscess of the pancreas (not diffuse suppuration). Chronic: (*a*) Interstitial pancreatitis: (1) interlobular; and (2) interacinar. (*b*) Cirrhosis of the pancreas.

Etiology.—The etiology of pancreatitis may be classified under predisposing and exciting causes. Among the predisposing causes are: (*a*) Obstruction in the ducts, the result of gall-stones, duodenal catarrh, pancreatic calculi, cancer of the

papilla or of the head of the pancreas, ulcer of the duodenum followed by cicatricial stenosis of the papilla, ascarides, and lumbrici. (*b*) Injury either from a bruise as by manipulation in operating, or from a crush, as by a blow in the epigastrium, or from wounding by a sharp instrument. (*c*) Hæmorrhage into the gland. (*d*) General ailments, such as typhoid fever, influenza, and mumps. (*e*) Certain anatomical peculiarities in the pancreas or its ducts. (*f*) Atheroma or fatty degeneration of the blood-vessels. The chief exciting causes are: 1. Infection conveyed either (*a*) from the blood, as in syphilis or pyæmia; (*b*) from the duodenum, as in gall-stone obstruction, or gastro-intestinal catarrh; and (*c*) by extension inwards from adjoining organs, as in gastric ulcer, or cancer eroding the pancreas. 2. Irritation, as in alcoholism (doubtful).

The anatomy of the pancreas with its ducts opening into a portion of the intestine, never free from organisms, is the key to the etiology of pancreatitis, but even so were it not that the common bile-duct and the pancreatic duct are so closely related the pancreas would probably generally escape. It is well known that even aseptic ligatures of the common bile-duct open the way to the presence of organisms within the bile-ducts and we have very definite proof that a gall-stone in the common duct is very shortly followed by infective cholangitis which may in unfavourable circumstances become suppurative cholangitis and lead to abscesses in the liver or to other secondary troubles. But in 28·5 per cent. (Testut) of cases the common bile and pancreatic ducts open together into the ampulla of Vater which itself opens into the duodenum, and, according to Helly, in 62 per cent. of cases the common bile-duct is intimately embraced by the pancreas, so that when a gall-stone passes down the bile-duct it must of necessity in a large proportion of cases compress the pancreatic duct and cause a damming back of its secretion, which, arguing from analogy as well as from practical experience of the troubles that follow, means damming back an infected secretion. Thus it is brought about that in many cases of common-duct cholelithiasis, where the calculus reaches the pancreatic portion of the duct and remains there for some time, catarrhal inflammation of the pancreas occurs. If the stone passes after a short period the pancreatitis may subside and leave no trace, or the swelling of the pancreas may persist and for a time keep up pressure on the common bile-duct, leading to a persistence of the jaundice, though there is no concretion left to cause obstruction nor any evidence of disease of the liver beyond the jaundice due to the mechanical obstruction. Thus may be explained some of the cases of chronic jaundice with so-called chronic biliary catarrh, a number of which cases I have operated on and found the condition I have just related. If, however, the gall-stone obstruction persists for some time and the patient's health is feeble or becomes seriously deteriorated what was

at first merely a simple catarrh may become a suppurative one, and as the same process involves the liver and the pancreas the ducts of both become filled with pus. We have now suppurative catarrh of the pancreatic ducts associated with a suppurative cholangitis, a very serious and generally a fatal condition, for which I have operated on four occasions. If the suppurative catarrh persists unrelieved it may lead not only to abscesses in the liver but also to abscesses in the pancreas and possibly, in case of survival, to subacute pancreatitis, as in the cases that I shall hope to describe under abscess of the pancreas. If the suppurative catarrh takes on an acute course the condition may become one allied to, and unrecognisable from, pyæmia, as in a case to be related later. If the infective catarrhal condition persists and does not assume the more dangerous suppurative form, or even if simple obstruction of the pancreatic duct persists from any cause with only mild

FIG. 8.

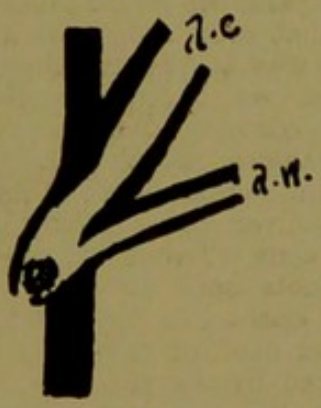


Diagram showing large diverticulum of Vater containing a calculus and illustrating one cause of hæmorrhagic pancreatitis. (Opie.)

infection, we may have an almost analogous condition to the one occurring in the liver that produces cirrhosis due to the development of fibrous tissue. In this more chronic form interstitial pancreatitis occurs which, I believe, in an early stage may be arrested by the removal of the cause, as I have proved in a number of cases that I hope to refer to under chronic pancreatitis.

The chronic pancreatitis at first assumes the interlobular variety and probably only much later, when it leads to true cirrhosis of the pancreas, does it take on the interacinar form and lead to alteration of the islands of Langerhans and thus to pancreatic diabetes. If a small gall-stone happens to descend into an unusually large diverticulum of Vater and to lodge there it will make a through channel from the common bile-duct, as shown in the diagram (Fig. 8), and this Opie has shown to be a cause of acute pancreatitis, the bile being forced direct into the

pancreas. In one case under the care of Dr. Halstead this condition occurred and acute hæmorrhagic pancreatitis ensued. Opie states that he has produced acute hæmorrhagic pancreatitis in dogs by injecting bile into the pancreatic duct. Other irritating substances, suspensions of bacteria, and various acids and alkalies have the same effect. It is quite clear, therefore, that gall-stones in the common duct are a frequent, in fact, by far the most frequent, cause of the various forms of pancreatitis, but the anatomical conditions just mentioned, though evidently potent, are certainly not necessary for the production of acute pancreatitis which may, as is well known, occur apart from cholelithiasis. Any gall-stone or stones impacted in the pancreatic portion of the duct, or even filling the ampulla of Vater, may be efficient causes of the trouble.

It may be asked, Why should not every case of common duct cholelithiasis be complicated by pancreatic inflammation? This is readily explained by the fact that in a certain percentage of cases the common bile-duct and the pancreatic duct open by separate orifices into the duodenum, while in another percentage the duct of Santorini is either the principal outlet for the pancreatic secretion or is of such a size that it can act as an efficient outlet even if Wirsung's duct becomes obstructed. The condition described by Opie, where the ampulla of Vater is very large and a small gall-stone becomes impacted at its orifice, is only rarely found, otherwise acute pancreatitis would be more common owing to overwhelming of the pancreatic ducts by infected bile. Besides gall-stones the other factors I have mentioned may lead to obstruction of the pancreatic ducts, to infection of the pent-up secretion, and to the different varieties of pancreatitis, the *rationale* of the process being similar to the one sketched above. It is possible that infection may extend upwards from the duodenum without preliminary obstruction, apparently by continuity of mucous membrane, catarrhal pancreatitis being then a sequel of gastro-duodenal catarrh. In case of injury, in whatever way inflicted, it seems not unreasonable to think that the soft glandular substance will readily yield and so set free the auto-destructive secretion of the gland, which by dissolving the walls of the blood-vessels will lead to further hæmorrhage and then to the collection of a quantity of easily decomposable material that only needs infecting to become acutely dangerous. The contiguity of the stomach and intestines furnishes the possibility of infection, though if infection does not take place the injury may be repaired as in other organs. This probably explains acute pancreatitis supervening not immediately but some days after an injury.

Hæmorrhage into the pancreas, so-called apoplexy, arising from diseased vessels or in other ways by disrupting the gland, may lead in the same way to pancreatitis, but as we know that hæmorrhage occurs at times without exciting inflammation, as shown by old blood stains in the pancreas

of some cases dying from other causes, it seems reasonable to argue that in such cases the exciting cause, infection, has been wanting. In general ailments, such as typhoid fever, influenza, &c., the well-known predilection of typhoid bacilli for the biliary passages would afford an easy explanation of their access to the pancreas and though it is difficult to prove I have in several cases of catarrhal inflammation of the pancreas obtained a history pointing strongly to influenza and to typhoid fever as the cause. In one case the relationship was proved by the discovery of typhoid organisms. As to mumps and pancreatitis there seems to be some peculiar and intimate relationship between the salivary glands of the mouth and the abdomen, and in the case of an adult friend, whose illness I had the opportunity some years ago of observing, it seems highly probable that a metastasis occurred about the third day of the disease when the pain and distress almost completely left the face and were followed by violent epigastric pain and alarming symptoms of depression, accompanied by sickness and fever, which then rapidly passed off after three days' anxiety and were followed by orchitis. M. Simonin[1] gave the result of his observations on 652 cases of mumps treated in the military hospital of Val de Grâce. In ten cases, or 1·3 per cent., there were symptoms of pancreatitis which occurred from the first to the twelfth day of the disease and lasted from two to seven days, the principal symptom being epigastric pain and tenderness, with sickness and vomiting. Among the blood infections have to be mentioned "pyæmia," which presents no special peculiarity in the pancreas, and "syphilis," which may affect the pancreas either as a tertiary affection in the shape of gumma or as a congenital affection as first described by Birch-Hirschfeld. It produces an interstitial pancreatitis of the interlobular type and the islands of Langerhans are unaffected. That the spread of ulceration inwards from the stomach may produce an indurative pancreatitis or even suppuration in the pancreas can be readily understood, for the ulcer must be constantly bathed with septic matter and the eroding action when once it has passed through the stomach wall may assume great activity.

The effect of the spread of ulceration is also well exemplified by the case (described later) of pancreatic abscess apparently due to gastric ulcer bursting into the stomach and setting up acute gastritis, for which I performed gastro-enterostomy with a good result. Whether alcohol can act directly in producing cirrhosis is, I think, a matter of great doubt, the probability being that it sets up a gastro-intestinal catarrh which by extension gives rise to the chronic infective process, or another explanation may be in the fact that alcohol causes vascular degeneration, a well-recognised cause of chronic interstitial pancreatitis. With regard to cirrhosis,

[1] Bulletin de la Société Medicale des Hôpitaux, July 30th, 1903.

the most chronic form of inflammation of the pancreas, which is though slow in its progress almost necessarily fatal from diabetes, the cause is probably a long-continued catarrh setting up interlobular and interacinar pancreatitis and which is originally due to infection. Vascular degeneration is ascribed as a cause in old or in prematurely aged persons.

Pancreatitis.

Historical references.—When studying the subject of pancreatitis in the light of modern pathological knowledge it behoves us to bear in mind that the older pathologists had noticed and described the naked-eye appearances of nearly all the conditions that are engaging so much of our attention at the present time. Tulpius so far back as 1672 describes a diffuse pancreatic abscess of pyæmic origin and Matthew Baillie, physician to St. George's Hospital, in a work on "Morbid Anatomy," published in 1799, describes what he calls a hard pancreas with the lobules distinct, but which, I think, when I throw a photograph of his drawing on the screen, you will agree with me is what we now should call a case of chronic interstitial pancreatitis. He also figures in the same volume a case of pancreatic calculi most carefully dissected and showing the relation of the bile and pancreatic ducts as you will see by the next photograph. The work which Dr. Maynard Horne pointed out to me has been kindly lent by Dr. R. Salusbury Trevor and is on the table. The photographs have been kindly taken for me by Dr. P. J. Cammidge. Portal in 1804 described a case of acute suppurative pancreatitis following on an attack of gout in the feet, and Percival in 1818 described a well-marked case of pancreatic abscess associated with jaundice. The following is a quotation from a paper by Dr. W. J. Mayo before the American Surgical Association, the executive committee of which approved of it for publication: "Balzer in 1879 first described acute pancreatitis with fat necrosis. Little attention was attracted to the subject, however, and it was not until Fitz ten years later wrote his classical papers that the medical world really became aware of the inflammatory diseases of the pancreas. Fitz soon after pointed out the fact that many supposed cysts of the pancreas due to traumatism were really accumulations of fluid in the lesser cavity of the peritoneum and the omental bursæ. A proper understanding of chronic pancreatitis has been largely due to Robson who first noticed the disease in connexion with his operative work upon the biliary tract. In fact, the surgical study of the inflammatory diseases of the pancreas may be said to be the result of an inquiry into the causation of some of the complications of gall-stone disease."

Catarrh of the pancreas.—From the foregoing remarks on the etiology of inflammation of the pancreas it will be seen

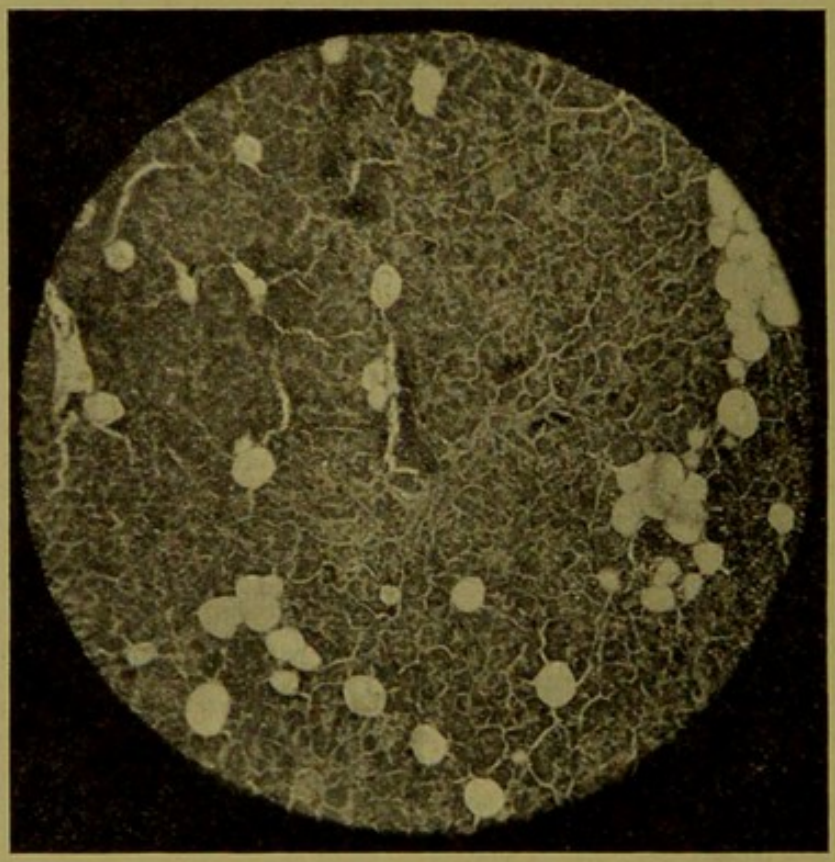
that I hold the view as to catarrh of the pancreas being a disease as well worthy of recognition as is catarrhal jaundice, which in the same way is dependent on catarrh of the bile ducts. It is held that biliary catarrh is known to exist as it can be so readily recognised by enlargement of the liver and jaundice, but that catarrhal pancreatitis is beyond recognition. I hope to be able to prove that these views regarding diagnosis will need revising, for catarrh of the pancreas can also be usually verified by digestive and metabolic signs and by swelling of the gland which can in some cases be recognised by palpation through the abdominal wall but in others only by manipulation of the pancreas through the opened abdomen. Just as catarrh of the bile-ducts may, and usually does, pass off if the cause be removed, so may pancreatic catarrh entirely clear up under appropriate treatment. Should the cause continue the catarrh will become chronic and an interstitial pancreatitis ensue which may end in cirrhosis or atrophy of the gland—a condition which probably always has a fatal termination from diabetes.

It will be seen that chronic interstitial pancreatitis is in many cases simply a sequence of pancreatic catarrh and as the latter is curable by appropriate treatment and the former when well advanced is only capable of relief and probably not of complete cure it is of the utmost importance that we should recognise catarrh of the pancreatic ducts at an early stage, and if in a short time it fails to yield to medical treatment that we should perform an exploratory operation with a view to remove the cause, whether that be gall-stones or some other removable condition ; but if the cause be not discovered or if when found it proves to be incapable of removal then drainage of the bile-ducts, either by cholecystotomy or cholecystenterostomy will nearly always afford relief: (1) by removing the infected bile and thus ridding the system of poison which tends to deteriorate the blood ; and (2) by removing the pressure of pent-up bile from the pancreas, thus relieving tension. Still another beneficial effect will result in some cases where the obstruction is at the papilla, for the pancreatic ducts will then also be drained indirectly through the bile-ducts. In certain cases of my own as well as in several occurring in the hands of other surgeons a mere manipulation of the gland without drainage has been followed by recovery and apparently by cure. An explanation of this result may possibly be that an obstruction in the shape of concretions or adhesions may have been inadvertently removed during the manipulation ; but in one of my own cases thus treated glycosuria has subsequently developed, which possibly might have been prevented by drainage.

Just as post-mortem evidence is not easy to obtain in simple catarrh of the liver, so it is reasonable to anticipate that pathologists will rarely find gross lesions of the pancreas even if opportunity for a post-mortem examination occurs in

the case of catarrhal pancreatitis. I am, however, able to show a micro-photograph of a case where death occurred in an aged patient 12 hours after operation apparently from a cerebral attack that came on during anæsthesia, where a gall-stone was impacted in the common duct and pressing on the pancreatic duct, the pancreas being found swollen at the time of operation. The presence of an inflammatory lesion of the pancreas was proved by a well-marked pancreatic urinary reaction before operation. At the necropsy

FIG. 9.



Catarrh of pancreas during incipient stage of interstitial pancreatitis.

no gross lesion of the pancreas could be seen, but I think it will be quite manifest to my audience that the photograph made for me by Dr. Cammidge and which I am able to demonstrate on the screen shows marked lesions in the shape of small-celled infiltration (Fig. 9), congested vessels, and incipient interstitial pancreatitis, and I suspect that careful investigation would demonstrate similar microscopic lesions in cases where no gross changes are manifest. I do not propose to occupy time in considering the symptomatology of acute and chronic catarrh of the pancreas, as the symptoms

and signs, though less in degree, are practically the same as those of chronic pancreatitis, under which subject I shall consider the matter more fully.

Suppurative catarrh.—This disease bears the same relation to simple pancreatic catarrh that simple catarrhal jaundice does to suppurative cholangitis and, like the latter, it is an extremely serious and frequently a fatal disease. In all the cases which I have seen gall-stones have been the cause, but why some patients should have simple catarrh ending in chronic interstitial pancreatitis and others should at once develop an acute suppuration of the pancreatic duct I am unable to say, unless one may surmise that in the latter class the infection may be of a more virulent character and the patient's tissues less able to withstand the attack. The disease tends towards death from septicæmia or pyæmia, or if the process be less acute or the vital powers more resistant it may possibly end in a localised abscess. Suppurative catarrh of the pancreatic ducts is generally, if not always, combined with suppurative cholangitis. The following four cases that have come under my care illustrate the serious nature of the disease.

CASE 1.—The first case is an example of suppurative catarrh of the pancreatic ducts ending in abscess of the pancreas. It occurred in a man, aged 40 years, who had suffered from continuous fever with exacerbations associated with rigors that recurred almost daily. He gave the history of failing health for nine months and of having had gall-stone attacks much longer, but the acute symptoms associated with jaundice had only been present for a fortnight before I saw him. The pancreatic reaction was found in the urine. At the operation on Oct. 11th, 1900, he was far too ill to bear a prolonged search and as the adhesions were very firm I felt it desirable only to drain the bile ducts through the gall-bladder, though a marked swelling of the pancreas made it appear probable that an abscess might be present. A large quantity of muco-pus drained from the gall-bladder and a number of gall-stones were removed. The abscess of the pancreas discharged through the drainage-tube, after which the pancreatic swelling subsided. The patient made a slow though steady recovery and returned home early in December. Though he was able to get out and to take food he never fully regained his strength and died in February of the following year. At the necropsy the pancreas was found to be much enlarged and to be the seat of interstitial pancreatitis. The cavity where the abscess had been was occupied by a little pulpy material but no further collection of pus was found nor were any gall-stones discovered in the bile-ducts.

CASE 2.—The second case was that of a woman, aged 61 years, suffering from suppurative cholangitis ending in

abscess of the pancreas. She gave the history of having been subject to biliary colic for three or four years, though there had been no jaundice till two and a half years ago, since when the attacks of pain had always been accompanied by rigors and by deepening of the jaundice. Within a short time of my seeing her the symptoms had become aggravated, and the loss of flesh had become extreme. The patient was so ill that the question of cancer of the pancreas was raised but the pancreatic reaction in the urine definitely pointed to inflammation and not to growth. At the operation I found the pancreatic portion of the common duct packed with large gall-stones and the head of the pancreas was markedly swollen. On passing the scoop through the opening in the common duct down to the pancreatic portion of the duct a stone of the size of a cherry was extracted, it being covered with offensive pus. This had apparently lodged in a cavity in the head of the pancreas. A profuse discharge of bile and offensive pancreatic fluid with pus continued to pass for a week, after which the discharge became gradually less. She made a good recovery and remains well a year later.

CASE 3.—The third case was one of suppurative cholangitis, pancreatitis, and parotitis with pyæmia in a woman, aged 65 years, the acute symptoms having come on within a fortnight, though there had been a history of gall-stones for years. The common duct was drained, gall-stones were removed, and a large quantity of extremely offensive pus and bile was evacuated. At the same time the right parotid gland (the seat of inflammation) was incised. The bile was examined bacteriologically and found to contain the bacillus coli in large numbers ; next in numbers were streptococci and another rather fine bacillus, which appeared to grow anærobically only, and there was a fine spore-bearing organism, probably the bacillus coli putrificus. The urine gave the pancreatic reaction. The patient, who also had heart disease and albuminuria, appeared to be doing well for 24 hours when she died suddenly, apparently from thrombosis.

CASE 4.—The fourth case was one of suppurative cholangitis and suppurative catarrh of the pancreatic ducts, due to gall-stones, in a man, aged 65 years, seen on Jan. 4th, 1904. He had had attacks of gall-stones seven years before and two seizures during the last two years, both of which were followed by jaundice. His present illness started on Nov. 23rd with severe pain followed by jaundice. On Dec. 20th a very severe attack of colic was followed by more intense jaundice and enlargement of the liver with irregular temperature. The patient had had albuminuria for seven or eight years. When I saw him there was tenderness above and to the right of the umbilicus and he had severe pain. A specimen of the urine was examined and found to give a

marked pancreatic reaction (pointing to acute inflammation) and to contain calcium oxalate crystals. On opening the abdomen on Jan. 7th firm adhesions were encountered and on detaching the omentum phlegmonous cholecystitis was discovered with gangrene of the fundus of the gall-bladder; pus escaped freely but the peritoneum was saved from being soiled by means of sponge packing. The common duct was enormously dilated but no gall-stones could be felt. On opening the common duct a large quantity of pus and bile escaped. By means of the scoop passed into the common duct and the fingers passed behind the pancreas a number of gall-stones were extracted, but a hardness could be felt at the papilla which could not be removed. The duodenum was therefore opened and the papilla brought within view. On laying this open a gall-stone was removed from the ampulla of Vater and pus was immediately seen to flow from the duct of Wirsung. The duodenum was closed. The gangrenous upper part of the gall-bladder was removed and the common duct and gall-bladder were drained. The patient bore the operation well and from that time onward had no more fever, but for the fortnight during which he lived his temperature was persistently subnormal. He had no peritoneal symptoms and the bowels were moved freely from the second day onward. Calcium chloride had been given before operation and at the operation he lost no blood. None was given subsequently to operation and on the eighth day there was rather free oozing of blood from the drainage track which had to be treated by gauze packing, after which the chloride of calcium was renewed and no more bleeding occurred. On the eleventh day the patient became somnolent and declined to take food. From this time he got gradually weaker and died comatose on the fourteenth day in a condition almost resembling that associated with acute atrophy of the liver.

The preceding cases are most instructive in that they illustrate one of the dangers of cholelithiasis, which might be avoided by appropriate treatment at an earlier stage, for the removal of gall-stones before the onset of deep jaundice and infection of the bile and pancreatic ducts is with due care and in skilful hands almost devoid of danger. So far as I know, these conditions have not been hitherto described as separate and distinct diseases, but I think the reasons I have given and the cases I have related will show a justification for separating catarrhal inflammation from the phlegmonous inflammation I am about to describe. Simple catarrh of the pancreas can be treated most successfully, but, as will have been noticed, suppurative catarrhal pancreatitis is quite as serious as acute phlegmonous pancreatitis and unless treated surgically must, I think, be almost necessarily fatal.

Acute Pancreatitis.

Symptoms.—Acute pancreatitis is usually ushered in by a sudden pain in the superior abdominal region, accompanied by faintness or collapse and followed sooner or later by vomiting. There is usually some epigastric swelling with tenderness from the first, and if the warm flat hand be placed over the epigastrium and retained there without movement for a time it will be found that the swelling is diffuse and not simply dependent on a distended stomach or colon though later, when peritonitis is established, the hollow viscera become inflated. It is almost constantly accompanied by constipation so that it is quite usual for these cases to be mistaken at first for intestinal obstruction. The obstruction, however, is not absolute, flatus passes, and a large enema may secure an evacuation ; if the patient survives for several days diarrhœa may supervene. The pain may be so severe as to produce syncope or collapse and though the pain does not quite pass away it has a tendency to be paroxysmal and to be increased by movement ; it is associated with well-marked tenderness just above the umbilicus and between it and the ensiform cartilage. The pain is soon followed by distension in the superior abdominal region which may become general, and usually does so in the later stages, and by vomiting, first of food, then of bile, and soon of black altered blood. The vomiting may be severe and each attack of sickness aggravates the pain. Rarely vomiting may not be a prominent symptom. Slight jaundice from associated catarrh of the bile-ducts and pressure is usually present and deepens the longer the patient survives. As the impaction of a gall-stone in the ampulla of Vater is probably the most frequent cause the jaundice may become intense from a complete stoppage of the passage of bile into the duodenum. The aspect is anxious and the face is pinched, resembling the facies of peritonitis which, in fact, is usually present. The pulse, which is rapid and small, is a better guide than the temperature which may be normal, subnormal, irregular, or high. In the ultra-acute cases the temperature is usually subnormal, but in the cases that survive for several days the temperature becomes irregular and may be excessive. Delirium comes on in the later stages. The distension and tenderness may prevent an exact examination of the pancreas which would otherwise be found enlarged. Death usually supervenes from the second to the fifth day from collapse, probably due to absorption of virulent matter, though in the less acute cases life may be more prolonged and recovery may possibly occur, as in one of my own cases related below, proved by laparotomy and the discovery of extensive fat necrosis, and by others reported elsewhere. Acute pancreatitis thus takes on the form of acute peritonitis starting in the superior abdominal region. If life be prolonged the condition may become one of subacute pancreatitis, the

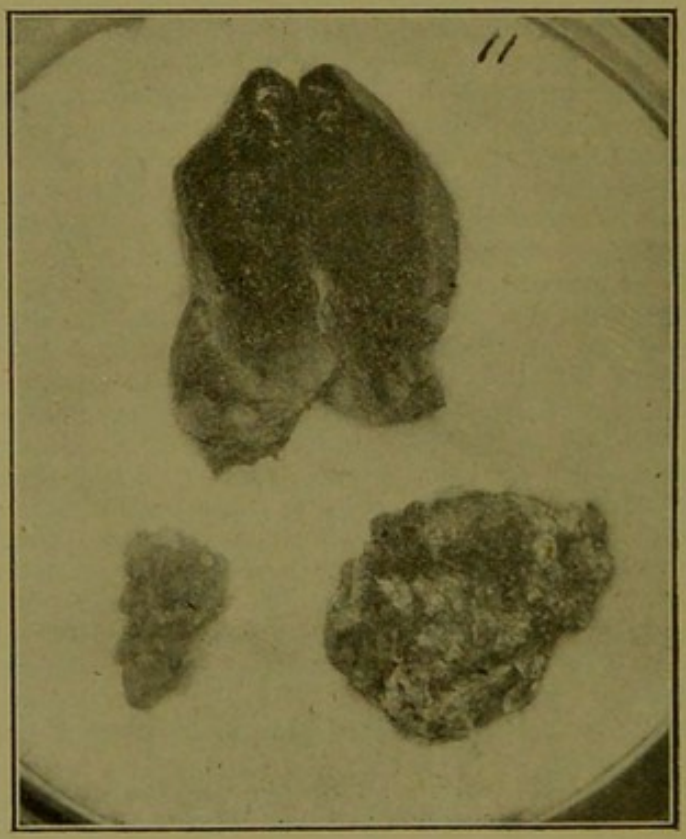
onset in such a case being usually less grave though often equally sudden. It is even possible for the trouble to resolve apparently completely and then for a relapse to occur, this sequence being repeated on several occasions.

The preceding description refers to acute pancreatitis generally and applies to the hæmorrhagic, gangrenous, or suppurative varieties which are phases of the same infective conditions though the morbid appearances differ so much. In gangrenous pancreatitis the organ is dry and dark or even black and there can be little doubt, as Opie has remarked, that this condition represents a late stage of the hæmorrhagic form. What has been previously said concerning pancreatic hæmorrhage will show that neither clinicians nor pathologists are agreed on this subject, some believing that inflammation precedes the hæmorrhage, among these being Fitz who designates the disease "hæmorrhagic pancreatitis," others holding that the hæmorrhage precedes inflammation which is, in fact, caused by bacterial infection of the hæmorrhagic effusion. Time will not permit of my pursuing the arguments employed in favour of each of these views but a careful study of the cases that I have seen and of all the cases reported inclines me to the opinion that both views may be correct in different cases, for although a primary pancreatitis may be accompanied by hæmorrhage yet this origin is not the only one and there are many cases in which hæmorrhage precedes and, in fact, is the cause of, inflammation; first, owing to the great tendency of the gland to disruption because of its soft structure when hæmorrhage does occur; secondly, owing to the setting free of the pancreatic secretion which decomposes and digests the damaged tissues; thirdly, owing to the communication of the gland with the intestine rendering the access of putrefactive organisms likely; and, fourthly, owing to the great tendency of the damaged gland and the effusion to become decomposed as soon as organisms gain access. From its proximity to the peritoneum acute peritonitis rapidly follows acute pancreatitis. I think that these two varieties of hæmorrhagic pancreatitis may at times be clinically differentiated, the ultra-acute, with a violent and sudden onset, accompanied by collapse and ending fatally with extreme rapidity, being for the most part the ones where the hæmorrhage precedes the inflammation and the somewhat less though still acute cases, where the onset is more gradual, where the symptoms are not ushered in by collapse, and where resolution and relapse are liable to occur, being the ones where the inflammation precedes the hæmorrhage. The varieties in which the inflammation precedes the hæmorrhage may in the severer forms approach to the ultra-acute or in the less severe examples approach the subacute varieties of pancreatitis. It seems to me that these views simplify the subject and place the disease of hæmorrhagic pancreatitis in a line with other well known inflammations. It would be quite easy, if time permitted, to give cases, both from my

own experience and from the extensive literature of the subject, exemplifying every stage of the disease from the ultra-acute to the most chronic form. The drawing I now show exemplifies a case of true hæmorrhagic pancreatitis where the inflammation was the cause of the hæmorrhage. It has been copied from Nothnagel and is taken from a case at the Harvard Medical School.

I will next show on the screen a well-marked example of hæmorrhagic pancreatitis from the Leeds Medical School (Fig. 10, marked 11 on the photograph) which occurred under the care of Mr. B. G. A. Moynihan and was dependent on gall-stones.

FIG. 10.

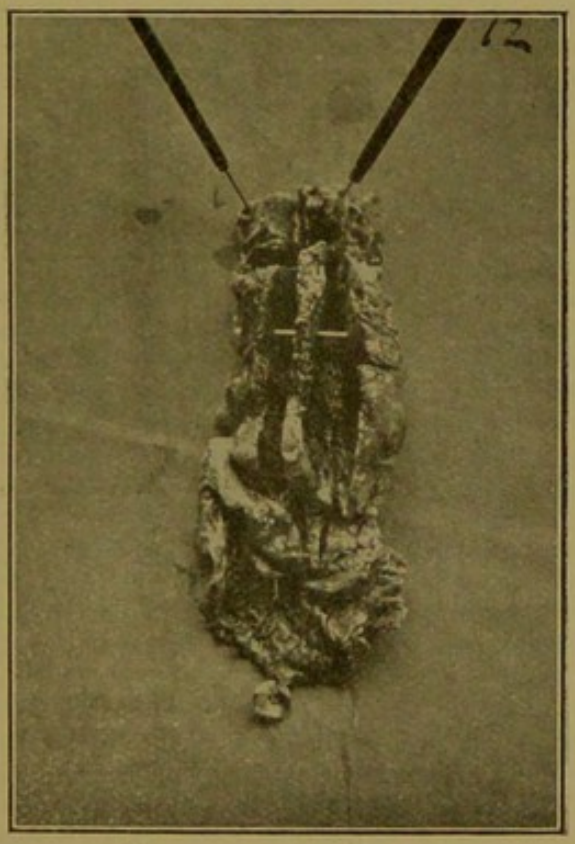


Hæmorrhagic pancreatitis due to gall-stones from a case in which the patient died shortly after operation. Fat necrosis is shown in the lower part. (Leeds Medical School Museum.)

A specimen next shown on the screen is from St. George's Hospital Museum, 204A, is a good example of hæmorrhagic or necrotising pancreatitis. The case was reported in THE LANCET of Oct. 19th, 1901, p. 1041 (Fig. 11, marked 12 on the photograph). [Two other specimens from the museums of St. Mary's Hospital and St. Bartholomew's Hospital respectively were shown.]

Diagnosis.—The diagnosis of acute pancreatitis is at first difficult as the symptoms are only characteristic of peritonitis starting in the upper part of the abdomen. Fitz's rule is worth bearing in mind: "Acute pancreatitis is to be suspected when a previously healthy person or sufferer from occasional attacks of indigestion is suddenly seized with violent pain in the epigastrium followed by vomiting and collapse and in the course of 24 hours by a circumscribed epigastric swelling, tympanitic or resistant, with slight rise of temperature." In case

FIG. 11.



Hæmorrhagic pancreatitis. Death second day after operation
No gall-stones were found. (St. George's Hospital.)

of laparotomy the presence of extensive fat necrosis is almost pathognomonic. At first the differential diagnosis must be made from intestinal obstruction, perforating duodenal or gastric ulcer, ruptured gall-bladder or bile-ducts, phlegmonous cholecystitis, and gangrenous appendicitis. In considering the difficulty of diagnosing between acute pancreatitis and intestinal obstruction it has to be borne in mind that the two may co-exist, as the swollen pancreas may embrace and strangle the duodenum or a collection of inflammatory material may seriously com-

press it. The swelling will, however, be usually less general in pancreatitis than in obstruction and, even if the bowels will not move, flatus can generally be passed. In case of doubt exploration may reveal fat necrosis. In perforation of a duodenal or gastric ulcer there will generally have been premonitory symptoms pointing to the disease before the perforation actually occurs and almost immediately an absence of liver dulness will usually be found. In acute ptomaine poisoning the history, the more general character of the pain, and the presence of diarrhœa will usually help the diagnosis.

In phlegmonous cholecystitis the symptoms are usually preceded by a swelling and well-marked tenderness beneath the right costal margin, at first distinctly localised and only later extending to the epigastrium and umbilical region, where the tenderness is generally found in acute pancreatitis; moreover, the history of gall-stones or typhoid fever will be elicited. In gangrenous appendicitis the tenderness below, and to the right of, the umbilicus and the swelling in that region usually remove the difficulty created by the pain in both appendicitis and pancreatitis being frequently felt at first just above the umbilicus. In acute pancreatitis the excruciating pain, at first epigastric but later general, the extremely rapid loss of weight, and the irregular tenderness opposite to, and above, the umbilicus are usually characteristic. Halstead [2] lays stress on two symptoms—the excessive pain and cyanosis of the face and of the abdominal wall. The former symptom is universal but the latter is not always present in my experience. The urinary test for the pancreatic crystals should not be neglected as a positive reaction has been obtained in all the cases of acute pancreatitis in which it has been employed. Glycosuria is usually absent but in two out of 41 cases of hæmorrhagic and in three out of 40 cases of gangrenous pancreatitis Korte found it present.

Treatment.—The pain at the onset is so acute as to necessitate the administration of morphine and the collapse will probably demand stimulants which on account of the associated vomiting may have to be given by enema. In the early stages the symptoms may be so indefinite that the indications for surgical treatment are often not clear enough to warrant operation, but as soon as acute pancreatitis is proved, as it may be by the combination of symptoms together with the urinary test, the surgeon must not wait until the collapse has passed off as that may be dependent on septic absorption which can only be relieved by operation. The simulation of intestinal obstruction will probably lead to efforts to secure an evacuation of the bowels and relief to the distension. Just as in perforative or gangrenous appendicitis an early evacuation of the septic matter is necessary

[2] Johns Hopkins Hospital Bulletin, 1901, Nos. 121, 122, and 123.

to recovery, so in this equally lethal affection an early exploration from the front through the middle line above the umbilicus or from behind through the left costo-vertebral angle is indicated in order, if possible, to relieve tension, to evacuate septic material, to secure free drainage, and to arrest the hæmorrhage which leads to disintegration and necrosis of the pancreas. The after-treatment will be chiefly directed to combating shock and keeping up the strength until the *materies morbi*, both local and general, can be thrown off. Even if no pus be found no harm should accrue by such an exploration which can be made in a few minutes through a very small incision in the middle line above the umbilicus, if necessary with the aid of cocaine. After establishing the diagnosis by the discovery of fat necrosis a posterior incision in the left costo-vertebral angle will enable the diseased organ to be very freely examined and if necessary drained for the evacuation of pus and gangrenous material without risk to the general peritoneal cavity and with little danger of retained septic matter, as the drainage will be a dependent one. If, however, the inflammatory collection or the tensely distended and inflamed gland be incised from the front, as is advisable in certain cases, gauze packing and gauze drainage may usually be relied on to prevent general infection of the peritoneum. If there are signs of obstructed common duct the gall-bladder should be drained and if gall-stones be discovered they should be removed if this can be done without seriously adding to the length of the operation or imperilling life by adding to the shock, otherwise they may be left and removed on a subsequent occasion if free drainage of the bile passages can be secured. I have had six cases of acute pancreatitis under my care and have operated on four, of which two recovered. Of the two cases where operation was not consented to and where medical treatment alone was carried out death occurred in the first case on the third day and in the second case after a week's illness, attended in both with great pain and incessant vomiting.

In a case of gangrenous pancreatitis in a man, aged 58 years, I was able to open a collection of fluid through the great omentum above the hepatic flexure of the colon and to extract a slough of the pancreas, afterwards draining freely. At the same time I drained the gall-bladder and removed all the stones that I could reach, but I did not venture to open the common duct as the patient was too ill to bear a prolongation of the operation. Fortunately, several small calculi worked back through the tube in the gall-bladder and recovery was not delayed and was ultimately complete. The pancreatic reaction was well marked in this case.

In another case of a young married woman suffering from acute suppurative pancreatitis the viscera were found hopelessly matted together. There was extensive fat necrosis all over the abdomen. I evacuated a subphrenic abscess containing masses of necrosed fat and dark pus. The

patient was only temporarily relieved and succumbed on the third day. In this case I think I ought to have drained through the costo-spinal angle on the left side as well as from the front, but the patient was so ill that I feared to do more lest death should occur on the table.

In a case of traumatic hæmorrhagic pancreatitis in a man, aged 28 years, on whom I operated, drainage through the loin as well as in front was adopted but did not save life, as at the time of operation peritonitis was already advanced.

In another case of a middle-aged medical man, whom I saw with Dr. H. P. Hawkins, the diffuse fat necrosis and adhesions of the viscera and omentum into a dense mass presented a formidable obstacle to complete exploration, but as no evidence of any collection of fluid either in the pancreas or in the lesser peritoneal sac could be obtained and as no gall-stones could be felt either in the gall-bladder or bile-ducts, I simply performed the peritoneal toilet and closed the abdomen, recovery following and ending in complete restoration to health. It is worthy of note that in this case the diagnosis was confirmed before operation by the urinary pancreatic reaction.

A case was reported [3] by Dr. Charles D. Muspratt, of a woman, aged 40 years, who had been admitted to the Royal Victoria Hospital, Bournemouth, on Dec. 3rd, 1903, in a state of collapse and suffering from severe abdominal pain with incessant vomiting. The abdomen was opened within 24 hours of the onset of acute symptoms and the omentum and intestines in the neighbourhood of the pancreas were found deeply blood-stained with numerous spots of fat necrosis. The pancreas was almost purple and extremely tense. An incision was made into the dark gland and very free bleeding followed which was arrested by ligature. Gauze drainage was employed and complete recovery followed. This is apparently the first case in which direct incision of the pancreas has been adopted and the operator is to be congratulated not only on having the strength of his convictions in treating acute hæmorrhagic pancreatitis on the lines of other phlegmonous inflammations but on the success of such treatment. In a case reported by von Mikulicz in 1903 a patient, under the care of Dr. C. B. Porter of Boston, was operated on by a deep incision into the inflamed gland with an excellent result. This is apparently the second case in which the pancreas was deliberately incised during acute inflammation with a successful result. Woolsey[4] gives a summary of three cases of this affection successfully dealt with by laparotomy and drainage. The first two cases were operated on in the early stage—the first on the third day and the second twelve hours after the onset. The first case was a hæmorrhagic one and showed fat necrosis, the second case showed no fat necrosis

[3] Brit. Med. Jour. Feb. 5th, 190 , p. 304.

[4] Annals of Surgery, November, 1903.

or bloody fluid, but the latter appeared on the removal of the gauze drain two days after the operation. In the third case there was marked but temporary glycosuria. Dr. C. G. B. Kempe of Salisbury on Dec. 11th, 1902, excised a portion of the head of the pancreas affected with acute hæmorrhagic pancreatitis. It was done within two hours of the onset of hæmorrhage. The patient unfortunately died from diarrhœa 15 days later. The argument that the percentage of mortality will be less if the surgeon waits for the formation of a local abscess is fallacious, as it takes no consideration of the large percentage of those who die before such a favourable result is presented, and in the second place many patients never develop a local abscess, the process being diffuse from the onset. The high mortality of an early operation in acute cases is due to the fact that in many of these fatal instances intestinal obstruction was suspected and the collapsed patients were subjected to a prolonged search for the seat of the supposed lesion. Of 59 reported cases of operation during the acute stage 23 recovered; these include my own cases and those just referred to. Although this is a large mortality it must be borne in mind that the disease is a lethal one and usually ends in death if not treated surgically. The lessons which one may learn from recorded cases are not to wait until the system is over-weighted with absorbed poison before operating and not to spend too long a time over the operation.

Subacute pancreatitis.—Although no hard-and-fast line can be drawn between acute and subacute pancreatitis, yet the less acute onset, the longer course, the limitation of the suppurative process by lymph barriers, and the much more hopeful outlook as the result of treatment present so many differences that I think clinical observers will see that such a division is desirable both from the point of view of diagnosis and treatment. Acute pancreatitis seems to me to bear the same relation to subacute pancreatitis that a diffuse mastitis does to a simple abscess of the breast or a diffuse suppurative parotitis to a simple parotid abscess. It may have a more or less sudden onset with acute pain and vomiting and may be associated with constipation, but collapse is not a marked symptom and is, as a rule, absent. The upper abdominal region does not become so rapidly distended and vomiting is less severe and less prolonged. At other times, and this is generally the case, the onset is more gradual though the symptoms may be similar. As gall-stones are the usual cause of this form of pancreatitis, a history of intermittent attacks of spasms, at first without and later accompanied by jaundice, will be elicited and before the onset of pancreatic trouble the symptoms of infective cholangitis, in the shape of rigors with deepening of jaundice and with intermittent fever, will generally be found. Tenderness over the pancreas is well marked and on account of the tympanites

being less than in the acute form it may be possible to feel the swollen gland, especially under an anæsthetic, and as the case progresses a definite tumour often develops. Constipation gives place to diarrhœa, and pus or blood may be noticed in the stools which have a very fœtid odour and usually contain fat and undigested muscle fibres. The pulse is not so seriously affected as in the acute form and the temperature is more irregular. I have seen the temperature reaching to 104° and 105° F. and yet the pulse to vary between 90 and 110. The morning temperature may be normal and the evening temperature high for several days or even weeks. Rigors or chills usually occur and may be repeated from time to time. The pain occurs in paroxysms but there is also a constant dull pain at the epigastrium. The patient may lose the more urgent symptoms and appear to be really improving, but the loss of flesh and feebleness continue and relapses usually occur leaving the patient each time more and more feeble until death supervenes from asthenia. Albuminuria is pretty constant, but glycosuria is rarely present. The pancreatic reaction in the urine is as a rule well marked. If an abscess develop the pus may form a tumour projecting in the superior abdominal region and forming a tender swelling behind the stomach, or perhaps coming to the surface above or below that viscus ; or it may burrow into either loin, forming a perirenal abscess, or passing under the diaphragm it may form a subphrenic abscess. Occasionally the pus may follow the psoas muscle and form a subperitoneal abscess in the iliac region, or even passing over the brim of the pelvis it may collect in the left broad ligament. I have seen most of these terminations in cases either under my own care or under the care of others and I have operated seven times for abscess of the pancreas. Sometimes the abscess bursts into the stomach and is vomited, or into the bowel and is voided per anum, after which diarrhœa may continue and pus may be seen from time to time as any fresh collection forms and bursts. I have seen both of these methods of spontaneous evacuation of a pancreatic abscess. With the evacuation of the abscess relief occurs for a time and the temperature improves but relapses usually take place and a mild form of septicæmia persists with a hectic temperature. Death is the usual termination unless an operation be done, though spontaneous recovery may possibly occur after a tedious and prolonged illness should the abscess burst into the bowel or be otherwise safely evacuated.

For the diagnosis of subacute pancreatitis in its initial stages I need add little to what I have said when considering suppurative catarrh and acute phlegmonous pancreatitis. The presence of a tumour or of a diffuse epigastric swelling behind the stomach will be generally found, or if epigastric tenderness prevents palpation an anæsthetic will enable the swelling to be felt. There is usually fever of a septic type. The presence of leucocytosis and the discovery of the pan-

creatic reaction in the urine will afford valuable aids to diagnosis. As soon as an abscess forms it may reach the surface above or below the stomach, in either loin, in the left iliac region, under the diaphragm, or even in the pelvis, and will require differential diagnosis from other conditions leading to a collection of pus in those situations, such as chronic perforative gastric ulcer, suppurative cholecystitis, splenic abscess, perirenal abscess, spinal abscess, glandular abscess, &c.

Treatment.—The subacute form of pancreatitis is more amenable to treatment, as the indications are so much more definite and there is more time for careful consideration. Though it has usually only been attacked when an abscess has formed and is manifestly making its way to the surface, yet there is no reason why in some cases surgical treatment should not be adopted at an earlier stage. As in the acute condition morphine may be required to relieve the pain and to lessen the collapse. Distension, if present, demands attention and may have to be relieved by lavage of the stomach and turpentine enemata or by the administration of calomel by the mouth. Calomel is also of benefit as an intestinal antiseptic, for which purpose it may be given in small repeated doses followed by a saline aperient. As soon as the constipation is relieved diarrhœa is apt to supervene, when salol and bismuth, with small doses of opium, may be given. If surgical treatment is decided on a median incision above the umbilicus will enable the operator to palpate the pancreas and to locate any incipient collection of pus which, if practicable, should then be evacuated by a posterior incision in the left or right costo-vertebral angle. If the posterior incision be thought impracticable the collection of pus may be removed by aspiration and the cavity opened and packed with gauze which may be brought forwards through a large rubber tube, which procedure will in the course of from 24 to 48 hours establish a track isolated from the general peritoneal cavity. In abscess of the pancreas, which usually assumes the form of subacute pancreatitis and which we must distinguish from the acute suppurative pancreatitis where the pus is diffused through the gland or where the abscesses are small and multiple, the suppurating process is limited by a pouring out of lymph, so that should the patient survive the initial more acute stage and discovery of the pus-containing cavity be made the condition is one decidedly amenable to treatment by drainage. The anatomical relation will readily explain the course along which the pus burrows should it burst through its lymph barriers—for instance, in one case I was able to evacuate an abscess from the right loin in a young man, aged 24 years, that had been mistaken for a perirenal abscess, yet the kidney was quite healthy and the grumous pus had come from the pancreas and passed behind the peritoneum covering the second part of the

duodenum. The patient recovered completely. In another case I opened an abscess in the left iliac region that had apparently started from the body of the pancreas and which had burrowed in the same way behind the peritoneum. The patient recovered from the operation but developed trouble in the left side of the thorax and died suddenly several weeks later. In one case that I mentioned under acute suppurative pancreatitis the abscess was subphrenic. In one case where the symptoms were rather acute and the patient was extremely ill I discovered pus between the liver and the stomach, and although drainage was apparently complete the patient succumbed in a few days to exhaustion due to the septic process that had been initiated before the abscess was opened. In two other cases, the sequence of suppurative catarrh, I have successfully drained abscesses of the pancreas through a tube in the common bile-duct after removing the gall-stones which had obstructed Wirsung's duct. In one of these cases the patient, a woman, aged 72 years, remains quite well, and in the other a man, aged 40 years, recovered from the operation but three months afterwards died from exhaustion and at the necropsy the empty abscess cavity was discovered in the head of the pancreas, the rest of the gland being affected with chronic interstitial inflammation. In one of my cases, in a man, aged 35 years, a pancreatic abscess burst into the stomach, setting up acute gastritis, the condition being proved by an exploratory operation. It was treated by gastro-enterostomy to drain away the foul stomach contents. The patient is now quite well, four years later. In another case, in a young married woman, aged 26 years, the abscess apparently burst into the bowel and though recovery was tardy she ultimately got quite well without operation. The diagnosis was made from the symptoms and by an examination of the swollen pancreas under an anæsthetic and subsequently by the presence of a pancreatic reaction in the urine. It is important in these cases to see that the cause is removed, if that be possible—for instance, gall-stones or pancreatic calculi—so that if recovery occurs there may be nothing left to lead to a recurrence of the trouble.

It will thus be seen that I have had eight cases of abscess of the pancreas under my care, one of which was mentioned under acute pancreatitis. Six were operated on, with recovery from operation in five, though in one of the cases the relief was only for a few weeks and in another for a few months. In the eighth case, which was not operated on, the abscess burst into the bowel and was discharged, the diagnosis having been made by an examination of the tumour under an anæsthetic and by the presence of the pancreatic reaction. When inflammation of the pancreas has ended in abscess chronic interstitial pancreatitis will also probably be present, as was shown at the necropsy of one of my cases that died some months subsequently. It is possible that in some cases the interstitial change may be local, though I

suspect in others it will be general and may then lead to atrophy of the gland and to glycosuria. A search through literature reveals a considerable number of pyæmic abscesses of the pancreas but those resulting from subacute pancreatitis are not common. Besides my own seven operations for abscess of the pancreas with two deaths, there have been seven others recorded with three deaths. Thus of 14 cases five died, giving a mortality of 35·6 per cent.

Chronic pancreatitis.—By chronic pancreatitis is understood an interstitial change in the pancreas of an inflammatory character leading to the formation of fibrous tissue. It may be *interlobular*, in which case it exerts pressure on, and causes atrophy of, the true glandular substance of the pancreas and interferes with its digestive function, or *interacinar*, in which case the fibrous tissue invades also the islands of Langerhans and leads, not only to an interference with the digestive, but also with the metabolic, functions of the gland and so to glycosuria. In cystic disease of the pancreas some interstitial pancreatitis is usually present and in many cases the chronic inflammatory process is the true cause of cyst formation. In an advanced condition the gland may be atrophied, small, and cirrhotic, almost like true cirrhosis of the liver, as in the specimen shown on the screen from St. Bartholomew's Hospital Museum. Chronic interstitial pancreatitis may be *primary*, as in those cases recovering from the acute or subacute forms of pancreatitis or from acute or chronic or suppurative catarrh, or it may be *secondary*, as in syphilis (Fig. 12), alcoholism, and arterial degeneration, and in the zymotic diseases, such as typhoid fever and influenza. The inflammatory process, which is in the primary forms essentially due to a mild form of infection, may be *general* throughout the gland or *limited* to certain portions, especially the head. The most frequent cause of chronic interstitial pancreatitis is cholelithiasis which causes obstruction to the pancreatic ducts and thus leads to an infective process which extends to the parenchyma; but anything causing duct obstruction, such as pancreatic calculi, stenosis from ulceration or growth, may act in the same way. It may also follow catarrh extending upward from a duodenal catarrh or from a cholangitis, or it may be due to the extension of an inflammatory process from the stomach, as in chronic ulcer eroding, or an acute ulcer perforating into, the pancreas. When our only source of information was the dead-house it was natural that only the more advanced conditions should be recognised and it is not surprising that the slighter changes in the gland were regularly passed over by pathologists, as indeed without great care they may be still, for it is to be borne in mind that in the primary stages of a catarrhal inflammation the swelling, which depends on an increased supply of blood to the part and on engorgement of the excretory ducts and which may be readily felt and recognised by the operating

surgeon, may after death almost entirely disappear, so that the pathologist may be unable to recognise any lesion except by microscopical examination, and even the microscope may in the early stages only show an excess of leucocytes in the tissues. Hence chronic pancreatitis was until recently only recognised when extreme and was looked on as a mere pathological refinement of no practical importance except in certain cases of congenital syphilis and alcoholism.

The surgeon has considerable advantages over the patho-

FIG. 12.

Chronic interstitial pancreatitis from a case of congenital syphilis, showing islands of Langerhans free from disease (Opie).

logist in cases like those under consideration, for he has the opportunity of examining and handling the living pancreas and after some experience he can tell the difference between the feel of the normal and the diseased gland, as well as between chronic pancreatitis and cancer. In interstitial pancreatitis the pancreas is uniformly swollen and harder than usual and the lobules have the feeling of being mapped out and differentiated in a manner very different from their state in the ordinary healthy gland and also very different

from the hard, nodular character presented by cancer of the head or body of the pancreas.

In July, 1900, in a lecture delivered in London, I had the privilege of pointing out the frequency with which an inflammatory enlargement of the pancreas accompanies gall-stone trouble, especially common-duct cholelithiasis, and which may not only persist after the original cause has passed away, but may simulate cancer of the head of the pancreas and terminate fatally under this supposition, when by efficient surgical treatment great relief, or even possibly cure, might have been effected. My attention was forcibly drawn to the association of gall-stones with inflammatory swelling of the pancreas by the frequency with which I found enlargement of the head of the pancreas and sometimes of the whole gland when operating for gall-stones. The symptoms of pancreatic catarrh passing on to interstitial pancreatitis present great varieties according to the cause ; for instance, if it be due to gall-stones there will be a history of painful attacks in the right hypochondrium associated with jaundice and possibly accompanied by fever of an intermittent type. Tenderness at the epigastrium with some fulness above the umbilicus will usually be noticed ; loss of flesh soon becomes marked and if the pancreatic symptoms predominate the pain will pass from the epigastrium round the left side or even to the renal and scapular regions. Fat and muscle fibres may be noticed in the motions as soon as the obstruction to Wirsung's duct is complete and the pancreatic reaction will be found in the urine. If gall-stones be not the cause there may be merely an aching or painful attacks not at all pronounced, or the symptoms may come on painlessly, associated with dyspepsia and with slight jaundice soon becoming more marked ; in such cases the gall-bladder may dilate and give rise to a suspicion of cancer of the pancreas which the rapid loss of flesh will tend to confirm. In the later stages pale or white and bulky motions may be passed and a hæmorrhagic tendency will be noticed. The liver is usually enlarged when the common bile-duct is tightly gripped and in several cases I have found cirrhosis of the liver, doubtless due to long-continued stagnation of septic bile in the ducts. I have seen well-marked enlargement of the spleen on four occasions. In one patient the fever and the enlarged spleen gave rise to a suspicion of ague, the organisms of which were said to have been found in the blood. An examination of the urine in all my cases gave the characteristic pancreatic reaction. In 60 per cent. bile was present in the urine. In 40 per cent. calcium oxalate crystals were found. In 4 per cent. only the oxalate crystals were associated with bile. In none of my cases was glycosuria found, though in two cases it developed several years later. Opie reports having found glycosuria in one out of 22 cases. Glycosuria only occurs as a very late symptom. Death may occur from asthenia due to long-continued jaundice or from diabetes or from hæmor-

rhage. The following is a brief description of some of the earliest cases on which I have operated.

The first case was in a woman, aged 44 years, who had for some time been suffering from deep jaundice with considerable pain, some irregular fever, digestive disturbance, and emaciation. At the operation on June 22nd, 1890, after separating a number of adhesions, I found a tumour of the pancreas embracing the lower end of the common duct, which at the time I thought to be malignant. The tumour was freely manipulated in order to ascertain if any gall-stones were present in the common duct, but none could be felt, and as the gall-bladder was contracted and there was some tendency to hæmorrhage from numerous small points I did not proceed further and the abdomen was closed. Whether any concretion was pressed onward into the duodenum I cannot say but the patient made a good recovery from the operation and within a few months had regained her health. A letter received this year from her medical man states that she is now, 14 years afterwards, in very good health.

The second instance of the kind was in a case on which I operated on Feb. 17th, 1891. The patient, a man, aged 50 years, was deeply jaundiced and supposed to be suffering from a gall-stone in the common duct, but on exploration no biliary concretion could be felt, though a swelling of the head of the pancreas was found. The patient recovered after a simple cholecystotomy and regained his health, but I have not been able to trace his subsequent history.

The third case occurred in April, 1892, also in a man, aged 32 years, who was extremely ill and emaciated at the time and suffering from deep jaundice and great prostration, with dilatation of the gall-bladder. Operation was undertaken too late and death resulted from shock and exhaustion on the second day. A necropsy revealed a cirrhotic condition of the head of the pancreas compressing the common bile-duct, there being no evidence of malignant disease.

The fourth case was in a woman, aged 51 years, who had chronic jaundice and irregular fever associated with spasmodic pains and great loss of flesh. Operation was performed on July 15th, 1895, when gall-stones were crushed and removed from the common duct, and a hard swelling of the head of the pancreas was felt which was thought to be cancer. The gall-bladder was connected to the duodenum to establish permanent drainage. The patient recovered and was in excellent health three years later.

The fifth case was a man, aged 56 years, who had had irregular pain and jaundice for a year with intensification of jaundice and fever after each attack of pain. The gall-bladder was distended. Operation was performed on August 27th, 1895. No gall-stones were found but three ounces of fluid tinged with blood were removed from the gall-bladder. A hard swelling of the pancreas was discovered. Cholecystenterostomy was performed. A report

was received two years later to say that the patient had gained weight after the operation and had been at his work ever since, though he had had occasional attacks of pain followed by slight jaundice.

The sixth case was in a man, aged 37 years, who had been operated on in another hospital for persistent jaundice. No gall-stones were found but a tumour of the head of the pancreas was felt and the case was thought to be one of cancer of the pancreas. A biliary fistula had persisted and though the patient was freed from the jaundice he remained feeble and thin. I performed cholecystenterostomy on July 13th, 1896. The patient made a good recovery and gained flesh and strength. A year later he was well.

The seventh case was a man, aged 34 years, seen in 1897. He had had painful attacks resembling cholelithiasis since June of 1896 and deep jaundice since December. The gall-bladder was distended and easily palpated. The patient was extremely ill and emaciated. At the operation on Feb. 25th, 1897, the gall-bladder was found to be dilated and surrounded by numerous adhesions but no gall-stones could be felt. Cholecystenterostomy was performed. The patient made a good recovery and rapidly lost his jaundice. Mr. H. L. Dowsing of Hull was kind enough to write on Jan. 24th, 1904, to tell me that the patient is now in good health and has never had a day's illness since his return home, the operation having taken place seven years ago.

The eighth case was in a woman, aged 49 years, who had had gall-stones removed from the gall-bladder three years before in Canada. She had never been free from jaundice since the operation and was subject to frequent vomiting. She was much emaciated, the stomach was dilated, and there was marked tenderness over the gall-bladder region. At the operation very extensive adhesions were found and the pancreas was much enlarged. Cholecystenterostomy was performed, after which she gradually regained her health. Dr. T. Kilner Clarke was kind enough to send me word on Jan. 24th, 1904, that the operation had been a complete success and the patient was leading an active life and was well six years after operation.

The ninth case, that of a man, aged 45 years, was reported fully in the lecture that I gave before the London Polyclinic in June, 1900. I had a letter from Mr. G. V. A. Robertson of Pickering on Jan. 25th, 1904, to say that the patient was in excellent health.

The tenth case was fully reported in THE LANCET of July 28th, 1900, p. 235. It occurred in a man, aged 42 years. In this case free manipulation of the pancreas only was performed and the gall-bladder although distended was not drained. This may have had something to do with the subsequent course of events. The jaundice persisted in a slighter degree for some length of time and although the patient is apparently well more than five years after the operation, yet he has developed glycosuria and the pan-

creatic reaction in the urine can also be obtained at the present time, thus pointing to the persistence of chronic interstitial pancreatitis which has invaded the islands of Langerhans. The presence of oxalates in the urine is also suggestive, though it contains no bile and no albumin. Had I drained the gall-bladder in this case I think it is highly probable that the sequelæ I have mentioned might have been prevented.

It would be easy to give further examples, for every one of the cases on which I have operated presents certain points of interest, but time will not permit this. When giving my lecture before the London Polyclinic I gave full details of several cases which can be found in THE LANCET of July 28th, 1900, p. 235. The diagnosis in the first series of cases was made from the course of events after operations at which a tumour of the pancreas was discovered and thought to be malignant and in which the patients regained health and remained well years subsequently, thus proving that the disease was not cancer, and by one case operated on in April, 1892, which came to post-mortem examination, in which the development of fibrous tissue in the head of the pancreas compressing the bile-duct was capable of demonstration. In the later cases other means of diagnosis in the shape of great emaciation and alteration in the stools, the result of imperfect digestion, excited more attention, but the most important diagnostic means was the discovery of the pancreatic reaction in the urine, by means of which we can usually say whether or not the pancreas is participating in the disease and also whether the affection be dependent on simple inflammation or on cancer. This test will, I hope, save many useless operations, for if it can be made to prove the presence of malignant disease of the pancreas along with jaundice operative treatment should then be avoided as being not only extremely dangerous but practically useless, even if the patient recovers from the operation. At times the test has forced one's hand with regard to operation, as when other symptoms and signs pointed to malignant disease, and operation had been pronounced undesirable, the urinary test has demonstrated on several occasions that what one thought might be cancer of the pancreas was either not dependent on disease of the pancreas and therefore possibly due to gall-stone alone, or that it was due to inflammatory and not to malignant disease of the pancreas, the result being that while in certain cases undesirable operations have been avoided, in others operation has been shown to be desirable and necessary to the cure of the patient. Although gall-stones in the common duct are often the cause of catarrhal or other inflammatory trouble in the pancreas, it does not follow that the sequence always occurs. For instance, if the gall-stone be too large to pass into the lower end of the duct jaundice will be unaccompanied by pancreatic disease, as in a case on

which I operated recently where a gall-stone of the size of a small walnut was present in the supra-duodenal portion of the common bile-duct and the pancreas was quite normal to sight and to touch ; moreover, in this case the urine gave no pancreatic reaction. It will also be unlikely to occur—(1) if the duct of Santorini freely communicates with Wirsung's duct and is able at the same time to discharge the secretion of the pancreas freely into the duodenum ; (2) if the duct of Wirsung and the common bile-duct open by separate orifices and the ampulla of Vater be absent ; and (3) if a gall-stone should pass rapidly into the bowel so that the obstruction is only of short duration.

The treatment of catarrhal inflammation of the pancreas and of chronic interstitial pancreatitis will at first be by general and medical means aiming at the cause, whether that be gall-stones, pancreatic calculi, duodenal catarrh, gastric ulcer, alcoholism, or syphilis ; but if after a fair trial of medical treatment, not too long continued, the jaundice and loss of weight continue, and the signs of failure in pancreatic digestion and metabolism are manifesting themselves, the question of surgical treatment should be seriously considered, for the condition is one that if not relieved early will certainly lead to serious degeneration of the gland. When operation is undertaken before the process has advanced to well-marked pancreatitis or to the interacinar form, my experience is that complete cure is effected in a very great proportion of cases, but if interstitial inflammation has become well marked an arrest of the process is all that can be looked for. As proof of this statement, in some cases, apparently well several years after operation, a pancreatic reaction can be obtained in the urine, while in two cases glycosuria has developed, thus showing that inflammation of the pancreas if at all advanced leaves abiding changes, and the sooner the morbid process is checked the less likelihood will there be of a permanently deficient metabolism. Surgical treatment will vary according to the cause and the symptoms. Where there is evidence of obstruction, whether in the pancreatic or common bile-ducts, the cause in the greater number of cases, 27 as compared with 24, will prove to be concretions which should if possible be removed and, as proved by my experience in this class of cases, the hope of relief is very promising.

Not only is it desirable to remove the cause of obstruction but at the same time the bile-ducts should be drained either by means of cholecystotomy or cholecystenterostomy. Where no obstruction in the shape of gall-stones or pancreatic calculi can be found I would still advise drainage of the bile-ducts by one of these operations. It has been argued that it is difficult to comprehend how drainage can do good in these cases ; for proof of its efficacy I would appeal to the list of examples that I have given and to the after-history of the cases which I have operated on. The drainage of the

bile-ducts acts, not only by removing one source of irritation in the shape of infected bile, but at the same time it relieves tension and allows the infected pancreatic secretion to escape, besides also freeing the blood from a poison which seriously damages it and the system at large. Besides the beneficial effects of drainage, in many of the cases the cause of obstruction is also removed. Whether advanced chronic interstitial pancreatitis will be completely cured by operation it is difficult to say, for in some of the severer cases a pancreatic reaction is found long after operation and after all other symptoms have cleared up, but in several cases that have been tested years after operation the pancreatic reaction has entirely disappeared, thus apparently proving that the case is cured. Moreover, I suspect that the operation arrests the process of disorganisation even if it cannot alter changes that have already occurred. Doubtless in some the disease was a catarrhal inflammation of the pancreas which was arrested either before interstitial inflammation had actually developed or before it had advanced too far, and probably in none of the cases had the interstitial change advanced so far as to become interacinar or to present the advanced stage of atrophy or cirrhosis, as in none of the cases was sugar present in the urine at the time of operation, though the metabolic functions of the pancreas were impaired as shown by the presence of the pancreatic reaction, and the digestive functions were affected as shown by the condition of the fæces.

Statistics of Operation for Chronic Pancreatitis.

In order to ascertain the after-results of the operations letters were recently addressed to the friends or medical attendants of all the patients who had not been recently heard of. In one case where the cause was due to pancreatic calculi these were removed both from Wirsung's and Santorini's ducts with complete recovery and the patient is now well. In 27 cases of catarrhal or interstitial pancreatitis, where gall-stones were found obstructing the pancreatic portion of the common duct, choledochotomy in 19, cholecystotomy in five, and cholecystenterostomy in three were followed not only by immediate recovery but, as ascertained by recent reports, the patients are now well, except one who has since died from acute bronchitis, one who is suffering from cirrhosis of the liver, and one who eight and a half years subsequently to operation is apparently well though sugar has recently been found in the urine. In 24 cases, where obstruction to the common bile-duct was due to an inflammatory condition of the pancreas compressing the bile-duct, though probably in many of the cases originally due to gall-stones yet where gall-stones were not actually present at the time of operation, the bile-ducts, and thus indirectly the pancreatic

ducts, were drained, in 12 cases by simple cholecystotomy and in nine by cholecystenterostomy; in three cases adhesions were separated and no drainage of bile-ducts was performed. Of these 24 cases 22 recovered. Two out of 51 patients died as a direct result of the operation, one a cholecystotomy undertaken in a patient reduced to the last stage of exhaustion before a surgical opinion was sought and where at the necropsy a cirrhotic condition of the head of the pancreas was found, and a second in which a cholecystenterostomy was undertaken in the presence of adhesions that appeared too formidable to deal with considering the poor condition of the patient who succumbed a few hours later. In this case necropsy revealed a stone in the pancreatic portion of the common duct which would have been discovered had the patient's condition permitted a thorough exploration. From four, the letters were returned as "Gone, no address." The remaining 16 completely recovered. Of three patients in whom the pancreas was found enlarged at operation, nothing beyond separation of adhesions and manipulation being done, all recovered. In one of these cases glycosuria has supervened and is still present, though the patient seems to be well. The after-history of one cannot be traced. Of the third word has been received to say that she is well, 14 years after operation. Thus I have no hesitation in advocating operation in this class of cases after general and medical means have had a fair but not too long a trial and the results I have given will, I think, justify my conclusions. A search through the literature of the subject has revealed the facts that (apart from my own cases, 51 in number, with two deaths, or a mortality of 3·9 per cent.) there have been 62 operations for chronic pancreatitis recorded, of which eight died, yielding a rate of mortality of 12·9 per cent. These cases have all been verified for me by Mr. A Clarke.

LECTURE III.

Delivered on March 11th.

Pancreatic Cysts.

Mr. President and Gentlemen,—I have nothing to add to the description, relations, and classification given in Diseases of the Pancreas (Saunders and Co., 1903,) where the subject is fully dealt with and may be studied at leisure.

The surgery of cystic disease of the pancreas is much in advance of pancreatic surgery as a whole and it is a subject in which all authorities are agreed as to the wisdom of simple drainage, which is usually sufficient to bring about relief or cure. In these cases surgery offers a poor opportunity for pathological investigation ; for when a pancreatic cyst is found, experience has shown that the patient's interest is best considered by a limitation of the incision to a size sufficient to empty and to drain it and not sufficiently large to satisfy pathological requirements. Hence it is highly probable that many reported cases of operations for pancreatic cysts have been for cysts of other origin, and it is an undoubted fact that quite a number of cysts originating from the neighbourhood of the pancreas are only pseudo-cysts, as in two under my own care, where in one a collection of blood and serum filled the lesser peritoneal sac as a result of injury and in another a pseudo-cyst formed rapidly around a necrotic pancreatitis and from the cavity a slough of the pancreas was removed.

The symptoms produced by a pancreatic cyst vary according to the size and seat of the tumour. They are at first dependent on the disease leading to the cystic formation and later to the pressure exercised by the tumour on neighbouring viscera, so that we find digestive disturbance with loss of flesh and epigastric uneasiness or some pain quite early, these being followed in certain cases by very intense pain occurring in paroxysms, by vomiting, constipation, jaundice, and wasting, and later by the presence of a tumour. Fatty stools, azotorrhœa, bulky pale motions, and glycosuria will be present or absent according to the amount of degeneration present in the gland. In all the cases I have observed recently there has been a well-marked pancreatic reaction in the urine, indicating catarrh of the pancreatic ducts or interstitial inflammation, and if this test holds good

for cystic disease of the pancreas generally, as I believe it does, it will, I think, form an important diagnostic sign in any case of tumour suspected to be pancreatic. In this connexion it may be well to remark that the most frequent cause of cyst development is chronic interstitial pancreatitis in which compression and constriction of the ducts result from a new formation of connective tissue with consequent stagnation of secretion. The Roentgen rays may also form a useful help in diagnosis in certain cases as they will establish the presence or absence of pancreatic calculi which are quite opaque to the X rays.

It is to be borne in mind that there have been cases of pancreatic cyst presenting very few symptoms except the presence of a tumour which have been under observation for a long time and have needed no active treatment, but these cases are exceptional. In my first lecture I referred to the importance of the peritoneal reflections from the pancreas on to the viscera and how they influenced the ultimate position and relations of pancreatic cysts. For instance, a tumour springing from the anterior surface of the head or body of the pancreas above the transverse mesocolon will project into the omental bursa and if small will bulge the stomach forward, or if large will either reach the surface above the stomach, between it and the liver, or pressing forward below the stomach it will bulge between it and the transverse mesocolon. On the state of the fulness of the stomach will depend the extent of contact of the tumour with the abdominal wall. If a cystic tumour arise from the pancreas to the right of the omental bursal reflection, it may make its way forwards to the right hypochondrium and simulate a gall-bladder or right renal or suprarenal cyst. Should a cyst arise from the posterior part of the head or tail of the gland it may project either into the right or left lumbar region and resemble a cyst of the kidney. If a tumour springs from the head of the pancreas below the reflection of the transverse mesocolon but to the right of the mesenteric vessels, it will reach the surface below the hepatic flexure of the colon on the right side and may simulate a right renal tumour or a tumour of the cæcum or ascending colon, as the mesentery will prevent it passing to the left of the spine; but should it arise from the small portion of the processus uncinatus on the left of the mesenteric vessels, but below the attachment of the transverse mesocolon, it may burrow between the layers of the mesentery and simulate a mesenteric cyst, or it may bulge on the left of the mesentery and reach the surface below the transverse colon on the left of the spine, when it may resemble a left renal or ovarian cyst or a tumour of the descending colon or small intestine.

Tumours springing from the pancreas on the left of the duodeno-jejunal junction, where the lower surface of the gland lies on the transverse mesocolon, have a tendency to press the great omentum forward and to project above the

transverse colon, but they may grow downward toward the central region of the abdomen and arch the transverse colon or even project below it so that the colon lies above the tumour. In an interesting case recently recorded by Dr. S. P. Phillips a thin-walled pancreatic cyst springing from the head of the pancreas completely filled the abdomen and presented the physical signs of ascites. Although usually unilocular, pancreatic cysts may be multilocular as in two of the specimens on the table, photographs of which I will show on the screen. I will now show on the screen several photographs to illustrate the anatomical relations of various pancreatic cysts that I have seen and the surface dulness on percussion that may be expected ; they have been recorded from the 12 cases on which I have operated.

Treatment.

Occasionally excision of the cyst may be performed, as in a case under my own care in a woman, aged 38 years, where the tumour returned after drainage and where the patient made a complete recovery after the second operation ; but the greater difficulty in performing excision, the impracticability of doing it always, and the greater mortality attending it as compared with the old operation of incision and drainage, render it quite clear that the lesser operation should always be tried first unless the circumstances be very exceptional. Aspiration and other forms of tapping are antiquated and ineffective methods which are attended with more danger than the operation of incision and drainage and therefore not to be recommended even for diagnostic purposes ; this also applies, though in a lesser degree, to operation *à deux temps* which is now rarely performed. As to the situation for drainage, that must entirely depend on circumstances ; the cyst will usually be attacked from the front, where it is manifestly nearest the surface. Occasionally it may be drained from the loin as in a case under my own care. Fistula does not as a rule follow the drainage of pancreatic cysts, but in some cases a small fistula may persist and I have known a fistula to go on for years without hurt to the patient and with very little discomfort. In the cases I have operated on, a cyst was enucleated on one occasion, recovery following ; drainage was carried out in nine other cases of true cyst and was followed by recovery in eight, whereas of two pseudo-cysts, one due to traumatic hæmorrhagic pancreatitis and the other to necrotic pancreatitis, one recovered. These I shall hope to report more fully before one of the London societies, as the time will not permit me to dwell longer on them now.

An extensive search through literature, in which I have been assisted by Mr. A. Clarke of the Royal Medical and Chirurgical Society's Library, who has verified the references

for me, reveals the following facts. 160 cases of operation have been recorded; in 140 recovery took place or is presumed to have taken place; in four cases the ultimate issue was doubtful; in eight out of the 140 of reported recovery after operation the patients died subsequently—one from diabetes four months later, one from tuberculosis three months later, one from hæmorrhage one and a half years later, one from concomitant peritonitis seven weeks later, one from a zymotic fever a few weeks later, and three from causes not stated a few weeks later Death is recorded as the result of operation in 20 cases. In five of these the cause and time after operation are not given. One patient died in collapse, one died before operation could be completed (the next day), one died from "ileus," one died 18 days after operation (cause not stated), two died from shock, one died from gangrene of the pancreas, and eight died from peritonitis. Of these eight dying from peritonitis, one died at interval not stated, one after 96 hours, one after six days, one after an exploratory incision, two after two days, one on the eighth day, and one on the second day. In 138, incision and drainage were performed with 16 deaths, equal to a mortality of 11·6 per cent. In 15 excision was performed, with three deaths, equal to a mortality of 20 per cent. In seven partial excision was done with one death, equal to a mortality of 14·3 per cent. Although larger numbers have been reported by others, the above figures are as nearly correct as appears to be possible, for on verifying the records sometimes the same case had been reported twice, in others wrong dates had been given, and in a few the details were so meagre that the nature of the operation was not given. The evidence is clearly in favour of drainage but the mortality should certainly be reduced by one-half. As to the frequency of cysts of the pancreas Dr. W. Hale White has recorded that in nearly 6000 post-mortem examinations at Guy's Hospital, 1883 to 1894, pancreatic cysts were only found in four cases and one of these was a hydatid cyst.

Injuries of the Pancreas.

Injuries of the pancreas have been so recently and so ably dealt with by von Mikulicz Radecki [1] that I need not spend much time on the subject. It is quite clear that injury to the pancreas is not necessarily fatal, as shown by the development of cysts the result of accident and their successful treatment. The indications for operation depend on the severity of the symptoms and on the presence of either hæmorrhage or inflammation, which may demand operation. If, therefore, after an injury in the superior abdominal region there be increasing anæmia, the signs of free blood

[1] Annals of Surgery.

in the peritoneum, or peritonitis, the surgeon will be called on to operate without delay. Severe injuries of the pancreas not operated on terminate fatally in nearly every case. Out of 45 cases of pancreatic injury collected by von Mikulicz 24 were perforating, 12 were gunshot, and nine were stab wounds. Of the gunshot injuries five were operated on, three recovering; the seven not operated on all died. Of the stab wounds all were operated on and eight out of nine recovered. Of the 24 subcutaneous injuries 13 were not operated on and all died. Of the 11 operated on seven recovered. No hard-and-fast rule can be formulated as to the method of treatment; the injured part must be exposed and either ligature of vessels or suture of surfaces adopted, but gauze tampons and drainage form important features in any of these operations, and where the peritoneum has been generally soiled with blood and pancreatic effusion lavage with hot saline fluid affords the double advantage of relieving shock and cleansing the abdomen. In view of the favourable results obtained by operation and the lethal effects of non-operative treatment, the only lesson that can be drawn is that we should make an exploratory laparotomy whenever there is a question of severe pancreatic injury. The photograph now thrown on the screen illustrates an extensive hæmorrhage in and around the pancreas the result of injury; it is from a specimen at St. Bartholomew's Hospital Museum, kindly lent for this lecture.

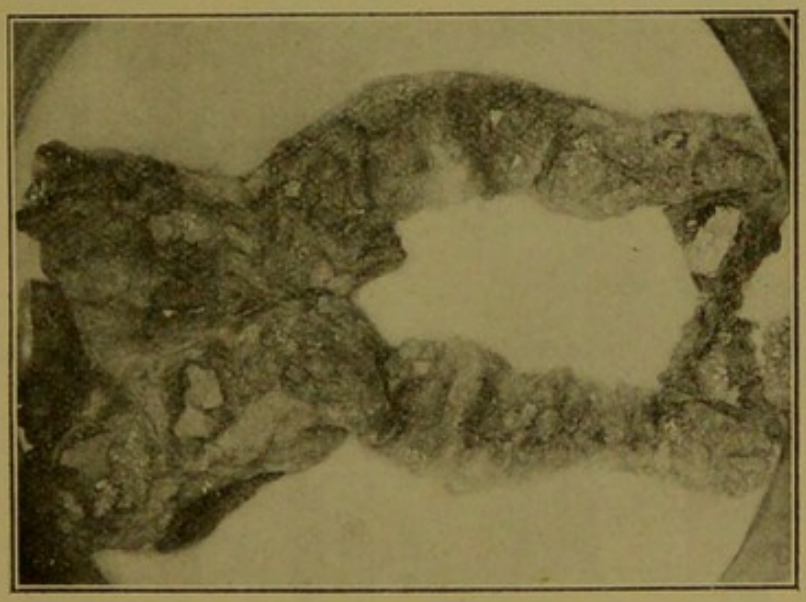
Pancreatic Calculus.

Although two cases of pancreatic calculi were observed by Panarol and Gaiea in 1667 and by others at later dates they are so uncommon that Oser quite recently said there were only 70 recorded cases. I have heard of seven since not included in that series but doubtless there are many unrecorded. The subject of pancreatic concretions can never assume the importance that attaches to cholelithiasis, but as they are associated with serious and usually progressive disease of the gland, and as they can be removed by operation, their recognition and treatment is a matter that demands some consideration. I believe that calculi never form in a healthy pancreas and it seems highly probable that, like gall-stones, pancreatic concretions are the result of catarrh of the ducts with stagnation of secretion, which generally if not always results from infection. Instead of calculi being formed the ducts may actually be lined with calcareous material that may accumulate so much as to close completely, or almost completely, the lumen. An example of this (for which I am indebted to the University College Hospital Museum) I will show on the screen. It will be noticed that the duct of Wirsung is widely dilated and that it also contains calculi.

A convenient term for this disease may be "pancreolithic catarrh." As a rule the calculi are numerous and in only three known cases has a solitary calculus been found. The photographs I now throw on the screen showing numerous calculi are from the Royal College of Surgeons of England and the Leeds Museum, to the pathological curators of which I am deeply indebted (Fig. 13). They all show multiple calculi and in every case it will be seen how seriously the glands have deteriorated. In every case they are the seat of cysts, dilated ducts, chronic interstitial pancreatitis or abscess, along with the concretions.

The composition of pancreatic calculi is important from the diagnostic point of view, for they contain lime either

FIG. 13.

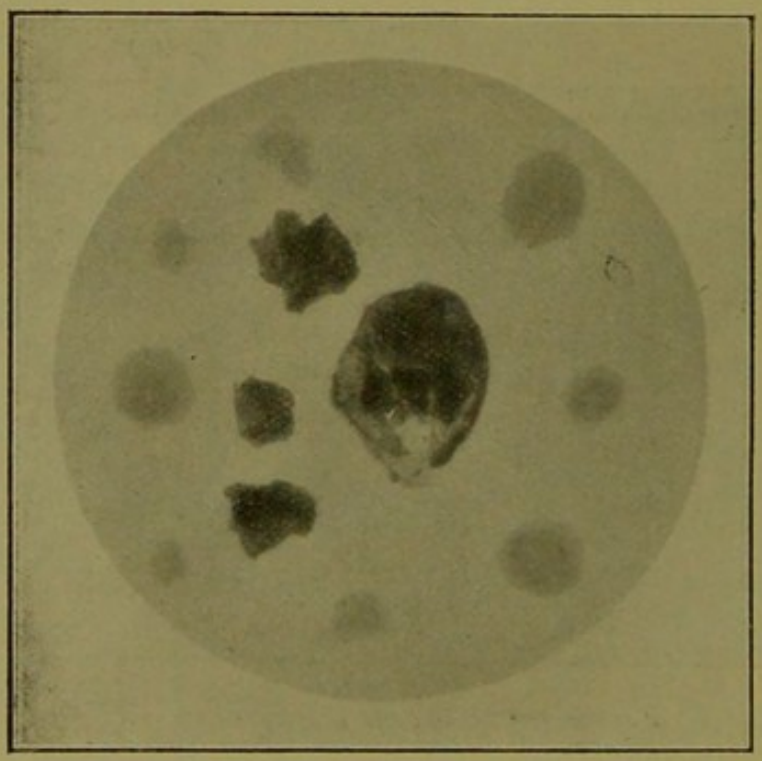


Pancreas containing calculi (Leeds Museum).

in the form of carbonate or phosphate or, as in one case reported by Mr. Shattock, of oxalate, which latter was found in a cyst. In examining the urine of cases suffering from chronic pancreatitis oxalate of lime crystals have been found by Dr. Cammidge in over 40 per cent. In jaundiced cases in which the bile acids take up the lime salts they have been found only in 6 per cent. of cases. It would be interesting to know if this fact has any bearing on the composition of pancreatic concretions, for it is a well-known fact that the normal pancreatic secretion contains no calcium carbonate. The subject is worthy of further investigation. The consequence of this chemical composition is that pancreatic calculi are opaque to the X rays and in this way we have a means of diagnosing their presence and of differentiating them from gall-

stones, which are not seen in a skiagram. I am able to show you on the screen an X-ray photograph of concretions taken from a case where at the same time I removed gall-stones and pancreatic calculi, and for comparison I show an ordinary photograph of the two classes of concretions together. The difference in their appearance in the skiagram is readily seen (Fig. 14) The next photograph, taken by Dr. J. Mackenzie Davidson, shows the calculi *in situ* and as the vessels have been injected they also show distinctly. So far as I know this method of diagnosis is here suggested for the first time. I feel confident that in future

FIG. 14.



X-ray photograph of biliary and pancreatic calculi.

it will be employed regularly and I believe that by means of the urinary pancreatic reaction we shall also be able to confirm the diagnosis by demonstrating the associated chronic pancreatitis.

I will now show on the screen a number of calculi showing their usual elongated shape. Shupmann has recorded a calculus measuring two and a half inches by half an inch and weighing 200 grains, and Matani has reported one weighing two ounces. In colour they are pale and they may be white, but if they pass into the common bile-duct they receive a covering of cholesterine and may be stained by the bile so as to look like gall-stones. The symptoms depend on the

associated condition, whether that be cyst, abscess, chronic inflammation, or other pathological state ; doubtless in some cases symptoms are vague or even wanting and in some cases pancreatic calculi have only been discovered post mortem. Glycosuria was recorded by Lancereux in 12 out of 40 cases. Pains at the epigastrium radiating towards the inferior angle of the left scapula, often agonising in character and associated with vomiting, may be present and the attacks may be brought on by exertion or may be irregular, coming on at any hour, day or night. Dyspepsia and flatulence are usually associated. Liporrhœa and azotorrhœa, as well as bulky pale motions, are present when there is well-marked interstitial pancreatitis, and in some cases where the interstitial changes have advanced to atrophy or fatty degeneration of the whole gland, glycosuria is found. The pancreatic reaction in the urine was well marked in a case on which I operated and I think it will be generally found. If a calculus descends into the ampulla of Vater jaundice will ensue and the case will probably be diagnosed as one of gall-stones in the common duct, but the urinary pancreatic reaction and the use of the x rays should enable a differential diagnosis to be made.

Medical Treatment.

The treatment by sialagogues, such as injections of pilocarpine, it seems to me, must be useless and mere waste of time. Relief to pain may be given by sedatives, and other treatment must be adopted as occasion arises, but as soon as pancreatic stones can be diagnosed they should be removed, as destruction of the pancreas is otherwise certain and it is quite clear that medical treatment can do no real good in these cases

Surgical Treatment.

Surgical treatment has until quite recently been merely palliative, but fortunately surgery can now offer a reasonable hope of cure. Some years ago I pointed out that the pancreatic duct could be readily explored by an incision in the second part of the duodenum and by then laying open the biliary papilla, when the opening of Wirsung's duct can be seen. In this way I have passed a probe two inches along the duct of Wirsung to explore it and have removed a pancreatic calculus from the duodenal end of the duct. A very exhaustive search through English and foreign literature, in which Mr. Clarke has helped me, has only resulted in the discovery of five operations for pancreatic calculi. Mr. A. Pearce Gould's case, operated on March 3rd, 1896, died on the twelfth day from exhaustion. In Dr. Dalziel's case a stone of the size of a very large pea was removed from the pancreatic duct through an incision in the

duodenum, the opening in the duct being stitched to the wound in the posterior wall of the duodenum. As the bile-duct was clear there was no jaundice. A good recovery followed. In Mr. B. G. A. Moynihan's case reported in THE LANCET of August 9th, 1902, p. 355, a pancreatic stone was removed from the ampulla of Vater through an incision in the duodenum and the patient recovered. In Dr. L. W. Allen's case reported in the "Annals of Surgery," 1903, p. 741, two calculi were removed from a cyst between the lesser curvature of the stomach and the liver. The patient died on the fifth day after operation. In a case under my own care, which has not been yet fully reported, I operated on Feb. 13th, 1903, on a lady, aged 57 years, and removed four calculi, one from the duct of Santorini or one of its branches by direct incision into the pancreas close to the common duct, afterwards closing the opening by deep and by peritoneal sutures ; the second and third stones I reached through an incision in the duodenum by laying open the papilla, when by means of fine forceps I removed a calculus out of Wirsung's duct, along which I afterwards passed a probe for two inches, and a fourth concretion I removed by direct pancreatotomy from the middle of the duct of Wirsung, the stone being reached by dividing the gastro-hepatic omentum, drawing the stomach downwards, incising the pancreas freely, and opening the duct directly on to the stone which was of the size of a small bean and which I show on the screen. The duct was then closed with catgut, the wound in the body of the pancreas being sutured so as to leave no dead space and the peritoneal wounds being closed without direct drainage. The right kidney pouch was then drained as some infected bile had escaped. Recovery was ultimately complete. In this case pain and vomiting were marked features and the pancreatic reaction was of the utmost importance from the point of view of diagnosis. This is, I believe, the first case in which either the duct of Wirsung or the duct of Santorini has been deliberately opened and, after the removal of a calculus, closed by a suture.

THE OPERATION OF PANCREO-LITHOTOMY.

For the purpose of removing calculi from the pancreas an incision one or one and a half inches to the right of the middle line will be found the most convenient, as the fibres of the right rectus can be split and the incision lengthened upwards and downwards without unnecessarily weakening the abdominal wall. A sand bag under the lumbar spine will bring the gland several inches nearer the surface. If the opening of the duct of Wirsung has to be explored, the second part of the duodenum may be incised and the papilla common to the bile and pancreatic ducts laid open, when the edges of the opened diverticulum of

Vater can be seized with small catch forceps and drawn to the surface; a probe or fine forceps can then be readily passed into Wirsung's duct and any concretion removed. If the calculi are more deeply placed in the ducts, the pancreas may be exposed either through the gastro-hepatic omentum by drawing the stomach downwards or by lifting the stomach it may be reached through a slit in the omentum. The calculi may be then cut down on and extracted by a scoop or forceps. Any bleeding must be arrested by ligatures. The duct can be sutured and the incision in the gland must be brought together by buried sutures, the peritoneal covering being coapted by a continuous suture. If leakage is feared a gauze drain may be applied but the position may be difficult for this and if it has to be done the gauze must be surrounded by a rubber drainage-tube and brought through it to the surface. In my case of pancreo-lithotomy I felt the closure of the gland was so secure as not to require gauze packing and the result justified my not using it. When the duodenum is opened it must be closed in the usual way by a muco-muscular and a serous suture, the latter being of fine celluloid thread. The incised papilla need not be sutured. If a calculus be felt in the head of the gland but not in the duct of Wirsung it may be reached by incising the peritoneum over the duodenum and separating it gently from the head of the pancreas, or if more deeply placed near the back of the gland the reflection of peritoneum from the duodenum to the abdominal wall may be incised and the duodenum may then be displaced inwards, when the back of the pancreas will be exposed and if thought advisable it may be incised and treated as in the incision from the front.

Neoplasms.

It is quite impossible in a short course of lectures even to touch on all the diseases of the pancreas. I must therefore under this heading confine myself simply to cancer and sarcoma, leaving for another occasion the study of adenoma, lymphoma, and the granulomata, tubercle, and syphilis.

Carcinoma.—Carcinoma is the most common of the neoplasms found in the pancreas. Out of 53,000 necropsies gathered from various sources where post-mortem examinations were presumably carefully made there were 226 cases of primary malignant disease of the pancreas (Roswell Park), but as these include Remo Segré's cases from the Ospedale Maggiore, Milan, in which the primary and secondary growths are not separated, the proportion of primary growths is probably not so large. Secondary growths are much more common, for instance, in Eppinger's statistics, of 1314 necropsies there were 308 cancers in various organs, of which 19 were in the pancreas,

but of these only two were primary. It seems advisable to remark here that all past post-mortem records with regard to cancer of the pancreas must be fallacious as until recently cases of chronic interstitial pancreatitis causing occlusion of the common bile-duct were not differentiated. The tumour in cancer may take the form of scirrhus or encephaloid cancer, columnar epithelioma or colloid cancer, and these are given in their order of frequency. I will throw on the screen examples of each of these forms, as well as examples of cancer of the liver secondary to cancer of the pancreas, showing how the secondary disease conforms to the type of the primary.

Cancer usually occurs after 40 years of age, though I have operated for cancer of the head of the pancreas at 32 years of age and rarely it has been known to occur in childhood. I have seen and personally examined considerably over 100 cases of cancer of the pancreas, in many of which the diagnosis has been subsequently confirmed by operation or by necropsy and my experience has been that loss of weight and strength with indigestion and general malaise are the first symptoms, pain being usually absent or unimportant; that when the head of the pancreas is involved jaundice rapidly ensues, the liver swells, and the gall-bladder dilates. The patient then seems almost to dissolve away, the loss of flesh being so rapid. The motions become pale, contain fat and muscle fibre if meat be taken, and the urine gives a well-marked and special pancreatic reaction. Sugar is only found when the whole gland is involved either in the malignant disease or by secondary interstitial pancreatitis of the interacinar type.

It is quite common to find in these cases evidences of pancreatitis superadded to the growth and this causes a change in the urinary reaction which may lead to an error in diagnosis unless it is borne in mind that such a sequence is possible. There is as a rule no difficulty in diagnosing cancer of the head of the pancreas from interstitial pancreatitis, as the urinary reactions are quite distinct if performed with care, and the general symptoms, especially the duration of the disease, will usually enable the diagnosis to be made. In exceptional cases, especially when the tumour is large and growing rapidly, pain may be severe and excruciating and if the stomach is invaded vomiting assumes a prominent place. The hæmorrhagic tendency, in connexion with cancer of the head of the pancreas and jaundice, is well known, but even in cancer of the body or tail of the organ a hæmorrhagic condition may ensue. Probably the excretion of lime salts from the blood may account for the hæmorrhagic condition and for the relief that can be given by the use of calcium chloride. Bleeding from the stomach or the mouth and from the intestines, or hæmorrhages under the skin are apt to occur spontaneously and to become serious or even fatal, and in case of operation, unless the blood be previously charged with lime salts, bleeding is

likely to occur in the shape of persistent oozing both at the time of operating and subsequently.

When the tumour attains any size it may be palpated from the front, but in ordinary scirrhus of the head of the pancreas no tumour can be felt, except enlargement of the gall-bladder which is generally present. Bronzing of the skin may come on if the adrenals are involved. Ascites or dropsy of the lower limbs may come on from pressure on the portal vein or inferior vena cava, or from secondary involvement of the liver, but apart from pressure, slight œdema of the feet is often an early sign. Death occurs from exhaustion as a rule within a few months and is never very long delayed—in fact, cancer affecting the head of the pancreas is more rapidly fatal than when occurring in any other organ.

The typical clinical picture of malignant disease of the pancreas may thus be drawn : a patient suffers for a time from indefinite symptoms of digestive disturbance, then jaundice appears, coming gradually but persistently increasing ; the gall-bladder is usually distended and the liver is normal or slightly enlarged. A tumour may be found in the neighbourhood of the pancreas. Cachexia rapidly develops and in some cases pain disturbs the patient's rest. There is soon a feeling of intense prostration and weakness. The fæces are massive and contain fat or fat-acids and an undue proportion of undigested muscle fibre. The urine contains albumin frequently and sugar and fat rarely. The whole clinical course is run, as a rule, within 12 months and after the appearance of jaundice within from six to eight months.

Differential Diagnosis.

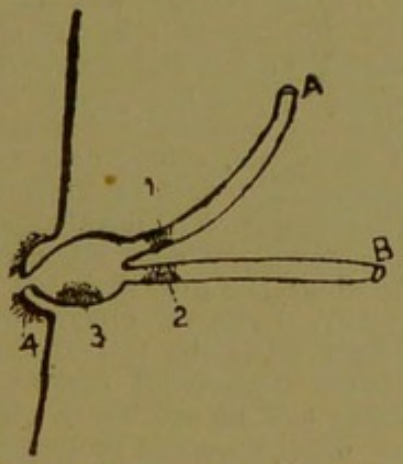
In malignant disease of the pancreas the symptoms are not constant. The cases may be divided into three chief types : 1. Where the tumour extends to the right and compresses or occludes the common bile and the pancreatic ducts. 2. Where it takes an upward and forward direction and besides compressing the bile-duct leads to pyloric stenosis. In this case to the typical symptoms are added those of dilated stomach. 3. Where the extension is backwards, causing compression of the vena cava and of the portal veins, thus leading to an early onset of ascites and later to œdema of the lower extremities. When the body and tail of the pancreas are involved the symptoms are atypical and the development of a tumour with steady loss of strength and increasing anæmia are such as might be due to any malignant tumour outside the pancreas. In the differential diagnosis of cancer of the head of the pancreas we must consider common duct cholelithiasis, interstitial pancreatitis, cancer of the common bile-duct, cancer of the liver, cancer of the pylorus, and chronic catarrh of the bile-ducts. Whenever in a patient at or past middle age

jaundice comes on painlessly and becomes absolute, at the same time that the gall bladder gradually enlarges so as to form a perceptible tumour and the patient rapidly loses flesh and strength, a diagnosis of cancer of the head of the pancreas will probably be correct. The diagnosis will be made more certain if there is an absence of tenderness below the right costal margin associated with a tumour opposite to, or above, the umbilicus, having communicated pulsation and not moving with respiration. On distending the stomach with carbon dioxide it will be found that the tumour, at the best rather indefinite, becomes hidden behind the resonant stomach and that the distended gall-bladder becomes pushed to the right. If cholelithiasis has preceded the onset of cancer the gall-bladder will not be enlarged but the rapid deterioration of health and the presence of anasarca and ascites will, as a rule, leave no doubt of the nature of the disease. In common duct cholelithiasis there is practically always a preliminary history of gall-stone attacks, though it may have been years previously. The jaundice will have come on after pain and is probably never absolute, for some bile nearly always escapes past gall-stones into the duodenum. The bile soon becomes infected and the ague-like seizures follow and an irregular temperature, at times almost resembling pyæmia. In place of a distended gall-bladder a rigid right rectus will be felt which often makes it difficult to examine the parts beneath. A tender spot will usually be found an inch above, and to the right of, the umbilicus and the pain will be found to pass backwards to the midscapular region or to a spot beneath the right shoulder-blade. Whereas in cancer of the head of the pancreas the disease is only a question of months, in cholelithiasis it may be one of years. Pancreatic catarrh or chronic pancreatitis frequently accompanies gall-stones in the common duct and clears up after their removal, but it may persist after the cause has passed away. Whenever a tumour of the head of the pancreas is felt during a gall-stone operation, especially if before middle life, hope may always be felt that the disease may be simple and may clear up by the drainage of the ducts. A long history is in favour of the simple disease, as are the presence of adhesions, the history of painful attacks, and the presence of tenderness above the umbilicus. In chronic pancreatitis it is not uncommon to find enlarged glands in the free border of the lesser omentum, but they are discrete when the disease is simple and generally confluent in cancerous affections. The jaundice may be absolute, but as a rule it is not complete. Infective cholangitis and infection of the pancreatic ducts are commonly present, as shown by the temperature and by ague-like seizures. Although the loss of flesh is marked it is less evident than in cancer of the head of the pancreas, and until the disease has existed for a longer time than cancer gives its victim there is no sign of anasarca or ascites or of

enlarged abdominal veins. The gall-bladder is seldom distended, though this is not an absolute rule, as I have seen it much enlarged on several occasions.

Between gall-stones in the common duct and chronic pancreatitis (which frequently coexist) it is often difficult to determine, but this is of no moment from a practical point of view, as surgical treatment is, as a rule, demanded in both conditions. Anæmia is much more marked in cancer of the head of the pancreas than in chronic interstitial pancreatitis. Cancer of the common duct is rare and is usually associated with gall-stones; if the disease involves the papilla the symptoms are indistinguishable from those of cancer of the head of the pancreas; but if it be situated above the opening of the pancreatic duct it will not interfere with the functions of the pancreas and therefore the loss of flesh will not be so rapid. In one case on which I operated

FIG. 15.



1. Growth commencing in common bile-duct A. 2. Growth commencing in Wirsung's duct B. 3. Growth commencing in diverticulum. 4. Growth commencing on papilla. (After Rolleston.)

suppurative cholangitis was present, but this is not a constant event. Cancer of the liver is distinguished by the jaundice being absent or much less intense and by the enlargement of the liver with irregular nodules on its surface and edges. The accompanying diagram shows the positions that growths may occupy in the neighbourhood of the papilla (Fig. 15). In simple catarrhal jaundice the symptoms are almost negative except for the jaundice and loss of appetite, and the way in which it yields to treatment shows the slighter nature of the ailment. In cancer of the pylorus the predominance of gastric symptoms and the dilatation of the stomach with absence of free hydrochloric acid and presence of blood in the vomit usually enable a diagnosis to be made, but it should not be forgotten that cancer of the pylorus and of the head of the pancreas frequently coexist. In all these cases the urinary test affords most valuable help in diagnosis.

Treatment.

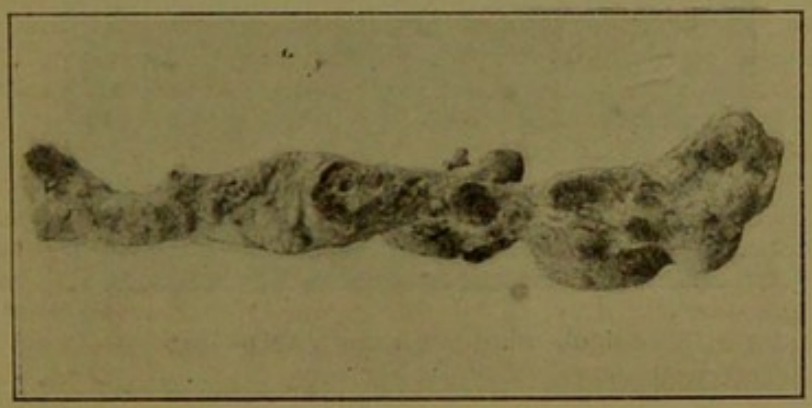
Medical treatment must be purely symptomatic ; morphine if needed for the relief of pain ; calcium chloride for the prevention of hæmorrhage ; pankreon tablets or liquor pancreaticus for the digestion of food ; and other remedies for symptoms as they arise. Surgical treatment is not very hopeful and has usually been undertaken under the idea that the cause of the jaundice might be a removeable one or that drainage of the bile-ducts might afford relief to the jaundice, but if the disease has involved the head of the pancreas it is hopeless however treated. Treatment may be radical or palliative. Ruggi of Bologna removed through the loin a cancer of the pancreas weighing 23 ounces. It was probably growing from the tail of the gland. Complete recovery followed and the patient was well for three months, after which secondary disease developed and the patient died at the end of six months. Professor Ruggi himself furnished me with these details. Cades' was the second successful case, in 1895, a tumour of the tail of the pancreas of the size of a child's head being removed. Terrier in 1892 removed a tumour weighing five pounds but lost his patient. Of 16 operations for removal of solid tumours of the pancreas, eight recovered, which, considering the difficulty of the operation and the depth of the organ to be operated on, is better than one would have expected. Successful pancreatectomies it will be seen are exceptional cases and are only feasible where the growth is not involving the head of the gland ; they, however, clearly demonstrate that a tumour of the body or of the tail of the pancreas may be removed with equal chances of recovery, and should the disease be primary and no secondary growths or glandular involvement have occurred, great prolongation of life is quite possible. Of the palliative operations, cholecystotomy and cholecystenterostomy for the relief of jaundice in cancer of the head of the pancreas, I can speak about very decidedly, as I have operated on 28 cases, all the patients being extremely ill at the time of operation. Many of these cases occurred when there was a difficulty in making a diagnosis between cancer of the head of the pancreas and gall-stones in the common duct or between cancer and interstitial pancreatitis, difficulties which have been overcome recently. Of the 15 cases in which the gall-bladder was drained eight recovered from the operation, the longest survival being eight months, but the average survival being about four months ; of the six cholecystenterostomies two recovered and the duration of life was only a few weeks. Even a simple exploratory operation in these cases is attended with danger, for out of six cases four only recovered from operation. Dr. Murphy of Chicago was kind enough to furnish me with a report of his statistics of cholecystenterostomy up to 1897. Of 67 non-malignant cases there had only been three deaths, but of his 12

malignant cases 10 died, giving a mortality of 83·3 per cent. Thus it will be seen that any palliative operation for the relief of cancer of the head of the pancreas associated with jaundice is useless, as, even if recovery occurs, life is not prolonged to any great extent.

Sarcoma.

Primary sarcoma of the pancreas is undoubtedly rare, though secondary disease, especially of the melanotic type, seems to be less uncommon. I have found examples of sarcoma in several of the museums, photographs of which I have obtained and will now show on the screen. The first is of melanotic sarcoma from the Hunterian Museum, the specimen being on the table (Fig. 16). It was taken from

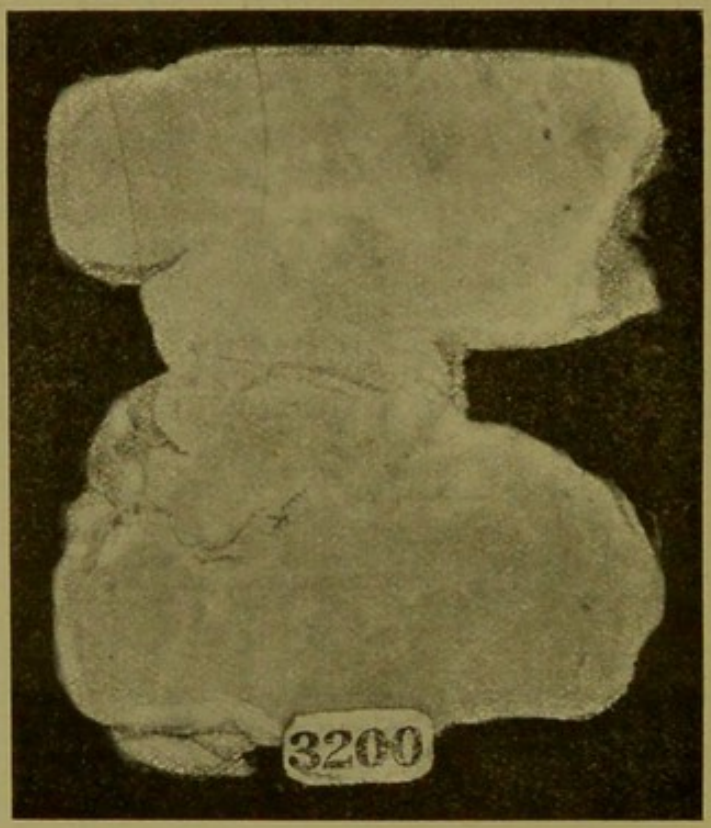
Fig. 16.



Melanotic sarcoma of the pancreas.

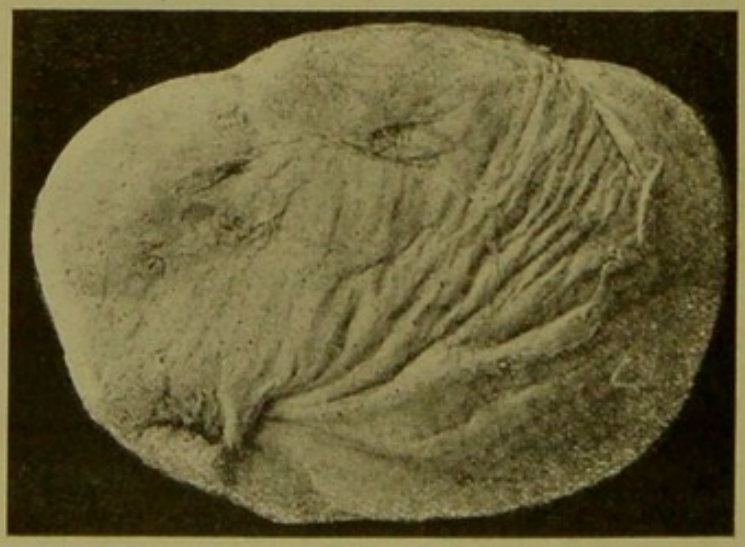
a girl, aged 20 years, and was secondary to a melanotic growth in the eye which was removed three years before her death. The next specimen shows melanotic sarcoma with fat necrosis. The next is from St. George's Hospital, No. 201 E, and shows a secondary sarcoma, the primary growth being in the thymus gland. The next specimen is a very large spindle-celled sarcoma from University College Hospital Museum, No. 3200 (Fig. 17). The growth has completely involved the gland and has left no trace of gland tissue. The next specimen (Fig. 18) I throw on the screen is on the table, No. 2836 A. It was removed from the tail of the pancreas but the child succumbed shortly after the operation. Operation for sarcoma of the pancreas is uncommon, though the few cases operated on prove that if the tumour be in the tail of the pancreas the case is one amenable to surgical treatment. I explored the abdomen in one case of the kind but found the disease too extensive for removal. Kronlein in 1894 removed a tumour of the size

FIG. 17.



Spindle-celled sarcoma of the pancreas.

FIG 18.



Sarcoma removed from the tail of the pancreas.

of the fist but the patient died seven days later. A tumour which was successfully removed by Briggs proved to be sarcomatous degeneration of an echinococcus cyst.

Mr. President, I must apologise for the imperfect manner in which I have been able to deal with the several subjects in my last lecture but want of time has compelled me to cut out much of what I should like to have said. I hope, however, that my lectures will be the means of exciting more general interest in the surgery of the pancreas, a subject which I feel is worthy of much more attention than hitherto has been accorded to it. It only remains for me to thank you for the patient hearing and the kindly interest that have been shown in what I have had to say and at the same time I would thank the Council of the Royal College of Surgeons of England for the honour they have done me in electing me a third time to hold this important chair.

Printed at The Lancet Office, 423, Strand W.C.