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The pancreas: with an outline of the general symptoms, diagnosis, and treatment, of cancerous and cystic lesions of the gland.

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The pancreas is a compound exocrine gland composed of tubules of a yellowish colour, held together by loose fibrous tissue. In shape, it is oblong and flattened from before backwards. It presents for examination two surfaces, an anterior and posterior, two borders, an upper and a lower, and two extremities. The right extremity is rounded and broad, the left extremity thin and tapering. These two extremities are spoken of as the head and neck of the pancreas. The intervening portion is spoken of as the body. The body and neck form a straight line which gradually tapers towards the tail extremity. The head is rounded, curved from above downwards, and is attached to the body of the gland at almost a right angle. Projecting from the posterior surface of the head at its upper part is a small lobulated fold of the gland. In some subjects it is detached, and is spoken of as the lesser pancreas. The average length of the gland is about seven inches, its weight about three ounces, its greatest breadth about one and a half inches, and its thickness from one half to an inch. The anterior surface is slightly concave, the posterior slightly emaciated, and the upper border thicker
Than the lower. Running throughout the length of the gland is a duct known as the canal of Wirsung. This duct commences at the tail extremity of the gland, and in its course through that part and the body is situated, nearer the lower than upper border, and nearer the anterior than posterior surface. In the head of the gland it passes obliquely downward to the right, nearer the posterior than anterior surface, and emerges from its substance on the posterior surface, about the middle of the curved and rounded border of the head, which is continuous with the upper border of the body and tail. The duct then passes obliquely through the inner and posterior surface of the wall of the descending portion of the duodenum, a little below its middle and enters the bowel through an opening on an elevated papilla on its inner surface. The common bile duct lies to the right of the pancreatic duct just outside the duodenum, and becomes incorporated with it in that position, so that the two ducts have a common orifice into the duodenum. The posterior lobulated fold, or lesser pancreas, has a separate duct which sometimes
opens into the canal of Wrisberg, and at
other times opens independently of it into
the bowel at a point near the common
opening of Wrisberg's Canal and the common
bile duct. The canal of Wrisberg is at some
subjects double up to its entrance into the
bowel. The pancreas is deeply placed in
the posterior part of the abdominal cavity,
and lies transversely across it from right
to left, at a level with the body of the
first lumbar vertebra. The head of the
gland lies in the right lumbar region.
The body in the umbilical region, and the
tail in the left hypochondriac region ac-
cording to Netter. Gray states that the
head lies in the right hypochondriac
region, the body in the epigastric region,
and the tail in the left hypochondriac
region. In its relations to the parts surround-
ing it, the head lies in, and is embraced
by the descending portion of the duodenum,
by which it is firmly attached on its
mesenteric inner surface. The descending
portion of the duodenum extends from the
neck of the gall bladder above, vertically
downwards in front of the right kidney
as far as the third lumbar vertebra.
The inferior pancreatico-duodenalis branch
of the superior mesenteric artery passes behind the superior mesenteric vein between the head of the pancreas and the duodenum and passes upwards curving round the head of the pancreas in the concavity of the duodenum to anastomose with the superior pancreaticoduodenal branch of the gastroduodenal artery, which descends along the margins of the duodenum and head of the pancreas. From these two arteries the head of the pancreas derives its blood supply.

The tail of the pancreas at its termination touches the lower margin of the spleen on its inner surface, which body lies against the left suprarenal capsule and the lower surface of the diaphragm, at a level opposite the ninth, tenth, and eleventh ribs in the axillary line. On its anterior surface the pancreas is covered by, and is in relation with, the posterior surface of the stomach, and is covered by the ascending layer of the transverse mesocolon. Behind the head of the pancreas to the right of the middle line of the body, lie the common bile duct, and, to the left of the common bile duct, the portal vein, which lies immediately in front of, and partly upon, the inferior vena
cavity. From right to left the pancreas lies upon the following structures, the body of the first lumbar vertebra, but separated from it by the abdominal aorta lying between the curves of the diaphragm. The gland lies upon this vessel between the origins of the celiac axis and the superior mesenteric artery. The superior mesenteric vein, the superior mesenteric artery, the inferior mesenteric axis, the left kidney, and suprarenal capsule, and the corresponding renal vessels.

The lobulated portion of the gland known as the lesser pancreas lies behind the superior mesenteric vessels. Immediately behind the pancreas lies the splenic vein, which in its course from the spleen is joined by the inferior mesenteric vein, and later on by the superior mesenteric vein, which together form the portal vein. Above the pancreas from right to left lie the first part of the duodenum, the hepatic artery from the celiac axis, the celiac axis, the splenic axis from which arises the splenic artery, which runs along the upper border of the pancreas to the spleen, and gives off branches in its course to supply the
Body and tail of the gland. These branches are called pancreatico-jejunale magna. The pancreatico-jejunale are small arteries which pass into the substance of the gland as they arise from the splenic artery. The pancreatico-jejunale magna is the largest of these branches, and enters the substance of the gland near the tail, and runs from left to right, nearer the posterior than the anterior surface of the pancreas. These arteries anastomose with the pancreatico-duodenal arteries. The veins of the pancreas open into the splenic and superior mesenteric veins. Below the pancreas lies in contact with the duodenum, the head with the descending portion, and the body with the transverse portion. The superior mesenteric vein and artery cross over the transverse portion of the duodenum to pass behind the pancreas, the vein lying to the right of the artery, and being in contact with the left side or border of the head of the gland. The pancreas receives nerve filaments from the hepatic plexus, the superior mesenteric plexus, and the splenic plexus, as of the sympathetic nervous system. The sympathetic vessels anastomose with those of the spleen, and terminate in the lumbar glands. The pancreas is invested on its outer
surface with a layer of fibrous tissue; internally it is made up of a number of parts called lobes, each of which is again subdivided into a number of smaller parts called lobules. The lobes and lobules are connected together by an acinar tissue, and are all in direct communication with the canal of Wirsung by means of ducts, which pass from it into the lobes, and then branching and subdividing pass into the minute lobules, where they terminate in minute sacs or acini. Each acinus is about one two hundredth of an inch in diameter, and is formed of a very thin membrane lined with glandular cells epithelium. In the acinar tissue connecting together the lobes and lobules, the blood vessels, accompanied by the nerves and lymphatics, ramify and subdivide and are finally spread out in capillary networks over the external surfaces of the acini. The ducts have thin walls composed of connective tissue, and elastic fibres and are lined by small cylindrical epithelial cells. The canal of Wirsung has an external fibrous coat, lined with mucous membrane internally. In the head of the pancreas it is about the size of an ordinary quill in calibre.
According to Professor A. Schaffer, the pancreas differs from all other secreting exocrine glands, in that it has scattered throughout its substance, islet cells, patches of an extremely vascular nature and pancreatic epithelium-like structure. The function of the pancreas is the secretion of a fluid, the pancreatic secretion, which passes by the ducts from the acini into the canal of Wirsing, to be excreted from thence into the bowel, where it plays an important part in the process of digestion. Pancreatic juice is extracted from the body during life, by means of an artificially made fistula through the abdominal wall into the pancreatic duct at the point where it pierces the intestinal wall, presents the following appearance and characteristics. It is a clear viscous fluid, alkaline in reaction when fresh, and on being shaken becomes frothy. It contains solid constituents which amount to about ten per cent. During twenty four hours the amount secreted is said to vary from twelve to sixteen ounces. According to Foster, it is composed of albumen, a pancreatic form of casein,
or alkaline albumen, serum, lipase, a small amount of fats and soaps, and a comparatively large quantity of carbonate of sodium, which seems to be peculiarly associated with the albumin.

The secretion of the juice seems to be indirectly related with, and to be regulated by, the central nervous system. N. O. Bernstein, after carefully studying the relationship between the two, arrived at the above conclusion from the observation of the following facts. In a dog, after a meal, he found that the pancreas became flushed with blood, and that a rapid secretion of pancreatic juice ensued, then followed a period of comparative quiescence in the gland, to be followed by a secondary secretion in the course of a few hours. The flushing of the gland, and primary secretion, he attributed to nervous impulses originating in the stomach or the inception of food, and the period of comparative quiescence to the period during which gastric digestion was proceeding. The secondary secretion, he attributed to nervous impulses following upon, and during the passage
of the chyme from the stomach into the duodenum, the chyme coming in contact with and stimulating the surface of the pancreas, closed opening into that part of the small intestine. On section of the vagus nerve he found that the secretion of the gland was arrested for a short space of time. Stimulation of the central portion of the same nerve also arrested the secretion and continued to have that effect for some time after the stimulus was removed. On inducing nausea and vomiting the secretion was also arrested. From these experiments he inferred that nervous impulses ascend to the brain, and there set an action another set of impulses, which descend from the brain to the pancreas by some other course, and so produce the effects observed. The same observer in another set of experiments claimed as completely as possible all the nerves going to and supplying the pancreas and found the effect produced was a continuous paralytic flow, which was rather diminished than increased by the introduction of food into the stomach. And unaffected or only very
very slightly so by stimulation of the vagus, or when nausea and vomiting was induced. Reichenhauer found on investigation that stimulation of the medulla oblongata increased the secretion of the pancreatic juice. He also demonstrated that the lining epithelial cells of the acini and the lobules of the pancreas, were composed of two zones, an inner, and an outer zone. In a fasting animal he observed that the inner zone in the lumen of the acini was granular in appearance, and larger than the outer zone, which was homogeneous or striated in appearance. The nucleus of the cell was irregular in contour, and placed partly in one zone, partly in the other. During digestion the relative of the zones was changed; the inner zone was much smaller, and in some cases had almost disappeared, whilst the outer zone was much increased in size. The whole cell was diminished in size, and the nucleus was spherical and regular in shape. From above observations he inferred that the epithelial cells lining the acini extract material from the
Blood during fasting is assist in the secretion of the pancreatic juice, and that during the process of secretion after the reception of food, the inner zones of the cells give off their accumulated material, whilst the outer zones are accumulating fresh material to supply and restore the inner zones during fasting, and thus prepare the gland for playing its part when again stimulated to do so by the fresh introduction of food into the stomach. The action of the pancreatic juice when it passes from the gland into the small intestine is of a threefold nature upon the chyme, with which it thus comes in contact. Firstly, it acts upon starchy matters and converts them into grape sugar; secondly, it acts upon proteins, and converts them into peptones; thirdly, it acts upon fats, emulsifying them, and splitting them up into their respective fatty acids and glycerin. The products of pancreatic digestion thus produced in the small intestine are to a great extent absorbed
and pass away from the bowel during the process of digestion. The highly diffusible substances and sugar are generally supposed to pass directly by a process of osmosis into the portal circulation, the emulsified and minute particles of fat are generally supposed to pass or be absorbed from the bowel through the lacteals and so pass into the lymphatic system to find their way ultimately into the general circulation.

In addition to the threefold action of the juice secreted by the pancreas, it is now generally believed that the pancreas also secretes some fluid or material which finds its way directly into the circulation, and thus produces a specific effect or restraining influence upon carbohydrate metabolism in the vital economy. This fluid or material is known, or spoken of as the internal secretion of the pancreas, in contradistinction to the pancreatic juice, which is known or spoken of as the external secretion of the pancreas, and which it was until within the
last few years supposed to be the sole function of the pancreas to produce Freyhan draws attention to the fact that in many cases in which an excessive amount of sugar in the blood has been shown to exist by its excretion in the urine during life, lesions of the pancreas have been found to exist or making a fatal postmortem examination, and argues from these facts that the excessive amount of sugar must be due to, or associated with, suppression of some of the functions of the pancreas. Freyhan and Rozansky corroborate his statements, as regards the common association, (as revealed by autopsy,) of pancreatic disease with the presence of an excessive amount of sugar in the blood, and excretion in the urine. That such is the case seems to be clearly proved by the experimental researches of Muizkowski and van Metering. These observers found that in complete removal of the pancreas from a rabbit to a healthy dog (if the animal survived the operation,) there was a great subsequent increase in the quantity
of urine excreted, and that the urine contained a large amount of sugar. The sugar appeared in the urine from twenty four to forty eight hours after extirpation of the gland, and reached its maximum amount in from two to three days.Mulderskiy further demonstrated that sugar does not appear in the urine, when during operation for its removal, the pancreas has not been completely removed, nor when portions of the gland have been transplanted from one part of the abdominal cavity to another part. In the latter case he demonstrated this by experiment on a healthy dog in which he detached a portion from the tail of the pancreas, but left it attached to the body by one vascular branch. The portion thus cut off, he stitched to the peritoneum of the abdominal wall, and also to the skin, leaving a fistulous opening. After waiting to observe that the transplanted portion retained its vitality, he then extirpated the remainder of the gland. On examination he found that there was no secretion of sugar
in the urine. On removing the trans-
planted portion, or in cutting off its vas-
cular supply later on, he found that
there at once ensued a copious
excretion of sugar in the urine.
Freyberg states that experimentally
four fifths of the gland may be
destroyed, and clinically a great por-
tion may be involved, without the
appearance of sugar in the urine.
Aebli, in a series of experiments,
found that on removal of the whole
or part of the pancreas in dogs, the
action of the excretory secretion of
the pancreas was interfered with also.
In the former case being of course entirely
absent, and in the latter deficient in quan-
tity. The effects he noted in regard to
intestinal digestion under these
circumstances were as follow:
In dogs in which the whole pancreas
had been removed, seventy-four percent
of the products of intestinal digestion
was still absorbed, where a portion of the
gland had been lost, fifty-four percent
was absorbed. In dogs without a pancreas,
the carbohydrates were for the most
part absorbed. When the pancreas
has been totally digested, the whole of the fats appears in the stools. When a portion of the pancreas is left, he observed that part of the fats is absorbed. In the internal secretion of the pancreas the specific effect or restraining influence on the carbonhydrate metabolism, so generally believed to be of the nature of a ferment, secreted by the pancreas, and which finds its way directly into the general circulation, without passing as in the case of the pancreatic juice into the bowels. Munsell Symmern states in support of this view that—"obviously, it would not be founded out, in all probability, into the common duct, as the ordinary amylolytic ferment would neutralise its action, but it would pass away from the pancreas by the portal vein." In the same article he quotes from Dr. Oakes' Principles and Practice of Medicine, in which he says:—"The pancreas has a double secretion, an external which is poured into the intestines, and an internal which passes into the blood; this latter is supposed..."
To be of the nature of a ferment, in the presence of which alone the normal assimilative properties can take place with the glycogen. Disease of the pancreas causes diabetes by preventing the formation of the glycolytic ferment. Manuel Symeason, by experiment found that if an aqueous solution of a freshly killed sheep's pancreas (which by experiment was found to be free of every trace of glycogen) was added to one of two similar solutions of glucose, and the two kept in an incubator at a temperature of 100°F for an hour, and then tested with Parny's modified Feulgen's solution, the one to which the aqueous solution of pancreas had been added would show much less sugar than the other.

Garnier found that healthy blood contains a certain percentage of sugar, but that if fresh blood be allowed to stand at the temperature of the body for an hour before examination, a certain portion of this sugar (from twenty to forty percent) will be found to have disappeared, upon examination of the blood.
From these observations he concluded that a ferment is present in the blood, which has the power of destroying sugar, and that this ferment is present in the corpuscles, especially in the white corpuscles, as he found that the glycolytic power of the chyle is as great as that of the blood. Von Mering and Minkowski further found that a transfusing blood from the caudal artery of a diabetic dog (in which the pancreas had been coagulated for twenty-six days) into the caudal artery of a healthy dog, there was found no sugar in the urine of the latter, after the operation. Vaughan Baverstock corroborates these experiments of Von Mering, Minkowski, and also finds in addition, that if the pancreatic juice be obstructed in its passage into the bowel, by ligature of the caudal of Winsor, or by any other means, sugar does not appear in the urine, whereas the gland becomes atrophied and wasted; whereas in ligature of its blood vessels and lymphatics, excess of sugar in
the urine enzymes at once. Lepine's theory as to the presence of a glycoytic ferment in the blood, although generally accepted, has never, however, been exclusively favored, and like all other theories has been subjected to much criticism. Explanation of certain facts discovered by Gaglio is necessary before Lepine's can be accepted, as being a correct, and perfect explanation of the origin of diabetes. According to Gaglio, the "something" which causes the phenomenon of sugar appearing in the urine after excretion of the pancreas, passes through the lymphatic vessels of the intestines, and it is due to an accumulation of this substance in the blood, and not to the absence of a glycoytic ferment that glycosuria ensues. This theory be based upon experiments in which he found, that if, at the same time as the removal of the pancreas, the left thoracic duct was ligatured, no glycosuria appeared, even after several days. He also found that ligation of the thoracic duct, in an animal which had been rendered diabetic, caused a cessation of the glycosuria.
Various theories have been adduced as to the origin of the glycolytic ferment, by those who believe that such a ferment is secreted, and passes directly into the circulation from the pancreas. Spurzheim believed that the secreting cells of the ducts and acini of the pancreas are bipolar or acinar, an inner part of the cell secreting the material which is forced into the bowl; an outer part of the cell secreting a substance which is forced directly into the circulation, and thus keeps in check the excessive formation of sugar. It is possible that this theory of Spurzheim may be connected in some way with the changes described by Heidenhain, in the cells of the pancreas, in which he observed that the pancreatic secreting epithelial cell was divided into two zones, which alternately increased and diminished in size, at the expense of one or the other. Another theory, as to the origin of the internal secretion of the pancreas has been adduced, and brought forward...
by Professor E. A. Schäfer. His theory is based upon certain experiments conducted by Thiebaut and Heilm, in which they found, that after injection of the substance of the pancreas through its ducts with paraffin, the gland rapidly withered and shrivelled up.

The same result was observed on injecting a portion of the gland which had been transplanted in the abdominal cavity. In both of these cases, after atrophy of the glandular tissue, no sugar was detected in the urine on examination.

Professor Schäfer inferred from these experiments, that as the secreting epithelium of the ducts and acini of the pancreas was destroyed in these cases, and as no sugar appeared in the urine, the origin of the internal secretion of the pancreas must be looked for elsewhere in the gland, than in these cells. In his opinion, the source from which the secretion is derived, is in the patches of interstitial, vascular epithelium, like tissue, which he describes as being scattered throughout the gland.
This theory is based upon the facts that, as far as is known, these patches of undifferentiated, vascular, epithelial-like tissue are peculiar to the pancreas amongst the secreting glands, and that in all probability, in fact, almost certainly, he says, these patches remain unaffected and do not shrivel up on the gland being injected through its ducts with paraffin. This latter supposition, he acknowledges has not as yet, however, been verified. Although there is considerable diversity of opinion as regards the pancreas and its secretions, as we have seen in the preceding pages, still the generally accepted conclusions of the recent clay regarding the gland and its secretions are, that the pancreas is an organ of great importance in the vital economy, in which it plays a twofold action. Firstly - that it secretes and discharges into the intestine a fluid that plays an important part in the digestive processes. Secondly - that it secretes a fluid or material
that passes directly into the circul-
ating from the gland, and there ex-
ercises a specific action upon carb-
hydrate metabolism. This specific
action is generally believed to be due
to the presence of a ferment, though
how and where this ferment is se-
creted in the gland, and its exact
nature, is still a matter of specul-
ation and conjecture. Furthermore,
that an excitation of the pancreas
exerted definite symptoms at
once ferment themselves, both as
regards the external and internal
secretions, the most important of
which symptoms are, the presence
of fatty matters in the stools,
and the presence of sugar in the
urine. When portions of the gland
are left, these symptoms either do
not appear, or, if so, in a modified
form, so long as not less than one
fifth of the gland is left. This latter
fact seems to negative entirely
the views held by earlier observers,
that glycosuria after excitation of
the pancreas was due to direct inter-
ference with the abdominal nervous system.
Of the diseases of the pancreas, the two most commonly met with are, cancerous and cystic diseases of the gland. As so of these two forms of pancreatic disease, we propose to consider the symptoms, diagnosis and treatment, in the following remarks.

But before doing so, it would perhaps be well to briefly look at the nature and etiology of these diseases. Cancer of the pancreas, like all other forms of that disease, whenever located in the body, is a most fatal form of disease, and owing to the deeply situated position in the abdominal cavity of the pancreas, and its close relations with important organs and structures, cancer must be looked upon, as the most important disease affecting the gland. Fortunately it is not a common disease, but, when it does affect the gland, as a rule it is due to extension of disease from some neighbouring part; on the other hand, it may arise as a primary affection, and in these cases tends to invade and affect neighbouring parts.

The disease is generally of a chronic nature, but may also, though rarely...
be of an encephaloid, colloidal, or melanotic carcinomatous nature. According to statistics recorded by Willoughby, out of four hundred and sixty-seven cases of cancerous disease, nine only were cancers of the pancreas, and of these the greater number were secondary to cancerous disease in other parts. The disease is rarely met with under middle age, and seems to be more common in males than in females. Injury to the epigastric region has been attributed as the cause of primary forms of the disease. The head of the gland is the seat in which the disease is usually developed, and in which it frequently remains confined; more rarely it is developed in the body or tail, but in some instances it spreads and ultimately affects the whole gland, which presents the appearance of a somewhat circumpolar, or nodular, hard dense tumour, varying in size, but never of large dimensions. When the head only is affected, it presents a more or less rounded tumour, and the remaining unaffected portions of the gland in these cases may be found
atrophyd or wrenched, in a state of chronic inflammation, or the ducts may be dilated, with the formation of cysts. Microscopically, the various forms of cancer present on examination the characteristics peculiar to each variety of cancer. Cystic disease of the pancreas, although comparatively rarely met with, is by no means uncommon. The cysts are generally well defined, may be single, or several in number, and may attain to a considerable size, containing in their cavities, either fluid which resembles more or less the ordinary secretion of the pancreas, blood, or caseous and congealed substances. The fluid contained in these cysts is acid, slightly alkaline, tasteless, colourless, and varies from a pale to a dark brown colour. Under the microscope it may show a great quantity of blood corpuscles, and small crystals. On mixing it with protoids, starchy matters, and fats, it may give the characteristic reactions of pancreatic juice with those matters. Brunner and Brunner mention a case in which they found the excretory ducts contained
... opaque, thick white pulp, and white and irregular, friable calculi, consisting of phosphate and carbamate of lime. The size of these calculi varies from a minute grain to concretions of the size of a walnut, or even larger, and may be few or many in number. They originate from retention of the pancreatic juice, and precipitation of its inorganic constituents, and are made up of carbamate and phosphate of lime. In appearance, they vary in shape, are white or grayish in color, and in consistence are usually soft and friable. Acute disease of the pancreas may originate from, and be caused either by interference with, or obstruction to the outflow of the pancreatic juice from the gland, or by vascular changes taking place on the surface of the gland. Senn states, 'that complete obstruction of the pancreatic duct unaccompanied with pathological changes in the pancreas... never results in cyst formation.' And that, 'the cause of cyst formation is chiefly an arrest of the absorption of pancreatic juice, due either to an...
admixture of pathological products rendered is incapable of absorption, or to a loss of function on this direction of the vessels which perform the task. In simple obstruction of the duct the pancreatic juice is re-absorbed. In cases in which normal pancreatic tissue is found in the cyst wall, the obstruction must be incomplete, as complete obstruction of the duct produces atrophy and degeneration. Changes which fibrose wall or obliterates the flow of the pancreatic juice from the gland depend, either upon conditions outside the gland, causing pressure upon the duct, or upon the glandular tissue, such as: - tumours of neighbouring parts, thickening or adhesions due to inflammation, a gall stone in the common bile duct, or enlarged glands; or upon conditions in the tissues of the pancreas, or in its duct, such as: - new growths in the gland, calculi, or gas tro-intestinal calculi spreading to and obstructing the duct. A localised obstruction may be brought about by any of these conditions. The result of obstruction of the canal of Wirsung is retention of the pancreatic secretion, and consequent dilatation of the main duct and all its branches. These dilatations have a serrated
and sphenial appearance, and as a result of increased pressure the walls become irritated and thickened, and by pressure upon the substance of the gland set up a chronic inflammation, which may subsequently cause destruction or wasting of the whole or part of the pancreas. Calculi may form pressure on the lining membrane, and walls of the ducts produce similar changes. Cystic disease may also be caused by vascular changes taking place in the tissues of the gland. These vascular changes are dependent upon solution of continuity in the vessels, which may be brought about, either, by violence from without, or from purifying disease in the vessels, such as: *arthritis rheumatica*, in which case solution of continuity in the vessels may result from any cause which produces increased pressure in the vessels. As a result of solution of continuity, in whatever manner produced, there is an effusion of blood into the tissues of the gland, which as a consequence are to a greater or less extent, according to the amount of hemorrhage, torn and separated from each other, and the cells or acini, and terminal, or possibly larger ducts destroyed.
Krebs asserts that incarceration is the only cause of pancreatic cystic formation, established with certainty, but that its mode of action is not very clear. From the deeply seated position of the pancreas in the abdominal cavity, and the manner in which it is covered and protected by other large organs, and partly also by the bony framework of the body, it is evident that force or violence sufficient to cause injury to the pancreas, either directly, or by bringing it against the body of the first lumbar vertebra, must be inflicted directly over the seat of the pancreas, or a backward direction must probably, and of considerable force.

Krebs holds the same views as Krebs, in regard to the causation of pancreatic cysts, and points out that in a large number of the district reported cases of pancreatic cysts, there has been a distinct history of previous injury over the seat of the pancreas. He gives a table of seventeen cases, in which there was a definite history of abdom-
inal injury, nine of these being caused or less directly connected with falls, six to blows on the abdomen, and two to being run over by vehicles. In all of these cases the injury was followed some time later by the appearance of an epigastric tumour, the earliest appearing ten days after the accident, the latest (making its appearance) eight years after the accident. Ninier, states that it has been denied by some writers that these cysts are traumatic in character. According to them the injury has produced some alteration in the glandular structure of the pancreas, and later on a true apoplexy of the gland ensues as a consequence of these changes. In favour of this view he contends that the interval between the injury and cyst formation, so frequently observed in these cases, bears out this view. Theodore Fisher, propounds another theory in which he suggests that these cysts may be due not to direct traumatisms, but to the result of nerve lesion, due to injury of the
sympathetic nervous system, and that although the appearance of pancreatic cysts so frequently follows an injury, it by no means follows that these cysts have their origin in direct injury of the pancreas. Catheart, who holds the same views as Guth states his opinion as follows:—"The injury causes a laceration of the gland. This is followed by extravasation of blood, and with this is mixed the pancreatic secretion from the bronch ducts. Not only is a constantly increasing fluid thus added to the original haematoma, but the collection of fluid probably becomes irritating in character. It will thus tend to excite the formation of a capsule around it and by chemical irritation and tension would gradually increase in size." In cases where arterio-sclerosis of the walls of the vessels is present any cause which produces increased tension on the vessels, or a slight injury might as easily be imagined cause rupture of the vessel, and hemorrhage into,
and destruction of the substance of the gland, leading to cystic formation, as described by Barthard. Another theory of cystic formation has been propounded by Fischer. He suggests that the origin of a pancreatic cyst following a severe abdominal injury may be due not to hemorrhage and the pouring out of pancreatic juice on the substance of the gland, but that the hemorrhage may occur outside, in close vicinity to the pancreas, and through tension and pressure on the gland may cause atrophy of part of its substance, and escape of pancreatic juice from the ducts being involved in the process of washing. The only one point on which these writers all agree is that injury or violence may and probably is the initial cause of many cases of cystic disease in the pancreas. It seems quite reasonable to connect together as cause and effect, these cysts which apparently follow an injury, and in these cases Barthard's explanation of cystic formation seems the most feasible and probably correct one. But in those
cases where cystic disease appears years after the injury, the explanation, either of Winter or of Fisher seems more probable. In any case it seems clearly established that injury and trauma may produce either directly, or later on, cystic disease in the pancreas, but as yet, as asserted by Keele, the nature of action is not very clear. From the close anatomical relations of the pancreas with other organs and structures, and the important functions which its secretions play in the economy of the body, it is to be expected that diseases which produce such changes in its tissues, as cancerous and cystic diseases do, should be accompanied by marked and definite symptoms, not only on account of the changes in the pancreas itself, but also from the effects upon the neighbouring parts and organs. In detailing these symptoms we shall do so under four headings.

(1st) Subjective sensations,

(2nd) Alimentary symptoms,

(3rd) Urinary symptoms,

(4th) Symptoms from physical effects.
are of an exceedingly indefinite nature, as in grave cases of disease in the gland. They may be almost entirely absent, or when present, so masked, or of such slight nature as to be overlooked. With regard to their location, any abnormal sensation located deeply in the abdominal cavity, in the region of the pancreas, which corresponds to a line drawn transversely across the anterior surface of the abdomen at a level about three inches above the umbilicus, and which becomes aggravated upon deep pressure, may be looked upon as being possibly due to disease of the gland. Subjective sensations are generally experienced as pain, which varies from paroxysms of the most acute agony, to a ill-defined sense of uneasiness, tension, or dragging. The more severe attacks are known as pancreatic colic. The attacks may occur periodically, and the sensation of pain be localized in one spot or spread over the abdominal cavity. Attacks of pancreatic colic resemble very much in their subjective symptoms, attacks of biliary and renal
coli, Carcinoma, as we have already seen may occur on the duodenum of the pancreas, and it is quite possible that in their passage into the bowel through the canal of Wirsung, they give rise to jaundice or jaundice of jaundice, although as a rule they remain latent. Wirsung records a case of jaundice of jaundice, in which a man was seized with severe epigastric pain, which became localized in a definite spot under the left costal arch within the nipple line. The attacks of pain recurred from nine to nine, and subsequently continued to an irregularly rounded shape, which could be crushed between the fingers, and which on section presented a dull white, non-laminated surface, were passed from the bowels. Holzmann also mentions a case, in which a man suffered from severe jaundice radiating at times to the right side, a dull aching sensation had been experienced in the abdomen for some time before the attacks of colic. No carciomata were found in this case.

Holzmann in an article on pancreataes knowledge...
in relation to epipli disease, states that pain is a prominent symptom, which comes on suddenly, is located chiefly in the epigastrianum, and may be accompanied by a sensation of heat in that region. There may also be dull pain just above the umbilicus, and referred deeply to the vertebral column. In a case of carcinoma, Dudding records that pain was a prominent symptom, and was felt especially in the back, but also all across the upper part of the abdomen. Guthrie Macklin cites two cases of pancreatic carcinoma, in which in case one, the pain was of a paraesymal character, beginning at the pit of the stomach, and radiating over the whole abdomen. In case two, the pain occurred periodically, and extended over the upper part of the abdomen, later, it became deeply localized in the epigastrian region. Further objective sensations in pancreatic disease may be experienced as a feeling of uneasiness and of oppression in the upper part of the abdominal cavity.
Snirmpo mentions a case of Professor Amgandali's, of a female suffering from cystic tumour of the pancreas, in which the subjective sensations experienced were a feeling of unusual fulness in the epigastric region, and abnormal pulsation. In cases where the pancreas is enlarged, and increased in weight, subjective sensations may be experienced, of a dragging nature, amounting in some cases to actual pain, by its effects on surrounding parts and tissues: the subjective sensations in such cases may be modified and affected by change of posture, as is exemplified in the following case, recorded by Theodore Fisher.

Case of a cancerous cyst connected with the pancreas. A man was seized whilst at work, with severe abdominal pain, worst marked on the left side, about the level of the umbilicus. The pain continued for some hours, when he discovered a lump about the size of his fist, above the umbilicus. In a few days the swelling disappeared, but he could not lie down.
either side with comfort, when on the right side something in the abdomen seemed to fall over, when on the left side, to press up. During the six preceding years he had suffered from periodic attacks of severe epigastric pain. Irritation of surrounding structures frequently gives rise to subjective sensations, as for instance, irritation of the peritoneum, involving the pancreas, or when either from simple irritation through pressure, or extension of disease from the pancreas, the nerve filaments and ganglia of the sympathetic nervous system become the seat of subjective sensations. In cases where these delicate structures become irritated or affected by disease from the pancreas, we would expect that subjective sensations would be well marked; that such is not however always the case is shown in an example, where acci- 
dental ganglia, and in which Mr. White states that the patient during life had only complaining of vague abdominal pain. Hence relates a case, in which after death the pancreas was found to be in a cirrhotic
condition, and its duct filled with calculi; during life, the patient, a man, suffered for nine years from severe cardialgia, which was subsequently looked on as pancreatic colic. In these two cases, it would appear that the subjective sensations were caused by extension of disease to, in the one case, and irritation of the nervous system in the other. When nerves in any part of the body are irritated, the subjective sensations observed are acute pains of a neurosensory character, so in like manner irritation of the nerves surrounding and supplying the pancreas, in disease of that organ may as suggested by Breche be reasonably presumed to be the cause of the subjective sensations observed in connection with carcinous and cyclic diseases of the organ. As the fluid excreted by the pancreas plays an important part in the processes of digestion, it naturally follows that where the secretion is interfered with, or arrested, either through disease in the gland, or mechanically,
certain changes in the digestive processes seem. Such changes are marked by symptoms, which are now supposed to include under the heading of alimentary symptoms. In connection with some cases of pyloric disease, a peculiar flow of a more or less thick and viscous fluid like saliva from the mouth, has been described as occurring at times. This symptom, in connection with these diseases is known as pyloric salivation, and various theories have been brought forward in explanation of its origin. By some observers, this flow is looked upon as a form of fayrosis, and by them is supposed to be due to an excessive watery secretion of pyloric juice into the duodenum, which regurgitates into the stomach, and from thence is ejected through the mouth by an act of vomiting or of emetogenesis. The more commonly accepted theory is - that the fluid is secreted directly by the salivary glands. These glands being affected either sympathetically or indirectly, and in consequence secrete an excessive amount of saliva. In explanation of this theory its supporters declare that as it is a
well-established fact, physiologically. That the salivary glands and the pancreas secrete fluids, which have a similar action, is so far that they both prepare the food for conversion starch into sugar, although the action of the former is of a much weaker nature than that of the latter; and also, that as it is frequently observed in connection with other glands in the body, that where one gland becomes incapacitated from any cause from secreting its natural amount or quality of fluid, a corresponding increase takes place in the activity and secretion of healthy glands which perform a similar function. So in disease of the pancreas, the salivary glands are stimulated to increased activity and secretion of saliva. Kollmann records a case in which salivation was a well-marked symptom, in connection with which he states that the salivation was due to disease of the pancreas, and not to the presence of vomiting or any gastric affection. The sufferer was a man, who laboured under
periodic attacks of pancreatic colic. during which salivation was noted. In conclusion he states that it cannot yet be alleged, whether salivation occurs in pancreatic colic alone or in other lesions of the pancreas as well. Gastric symptoms are usually present to a greater or lesser extent in the form of dyspepsia, but cannot be relied upon as giving any direct evidence of pancreatic disease. Intermittent thirst and hunger are in some cases well marked symptoms, as we shall see later on, in connection with certain changes in the urinary secretion. As the pancreatic secretion finds its way directly into the bowel and these plays its part in digestion, it is in the bowels that one would expect to find symptoms indicating some disorder of function in the gland, when such exists. Such as interstitial indigestion, constipation or diarrhea. These symptoms are in many cases more or less present, but are of too indefinite a character to be of much value in diagnosis, unless
associated with another and special symptom which is looked upon as being pathognomonic of pancreatitis, namely.—The presence in the stools of free fat or oily matter, indicating absence of, or abnormal quality of the pancreatic excretion. This symptom has been found in a considerable number of cases, and when present is one of great importance, still it is not always present, and has been chiefly noticed where the flow of bile into the bowel, was at the same time interrupted. The quantity of fat passed from the bowels, and also its characteristics vary greatly in different cases. The quantity may greatly exceed the amount taken into the stomach as food, and in these cases is supposed to be absorbed from the general system, and discharged from the bowels. In character fat found in the stools may present three different forms,—firstly, as lumps of solid, which may constitute almost entirely the whole discharge from the bowel.
in colour, presenting a pale yellow hallowing appearance; seemingly, as an oily body, mixed with faecal matter. On cooling the oil separates from the faecal matter, and may be observed floating on the surface. Alfred Clark records a case in which after death, the pancreas was found to be cystic at its extremity, the head and body completely altered in structure, being converted into a mass of fatty tissue, and the canal of Wirsung close to its orifice completely occluded by a mass of calcareous matter. The bile duct was not obstructed. During life the patient suffered for years from hepatic disarrangement, associated with attacks of biliary colic. About four months before her death, masses of yellow, greasy looking matter in colour, consistency, and general appearance, were observed floating on the surface of the urine on cooling. On examination, the same fatty material was found in the faecal matter. Its presence in the urine was found to be due to the escape of oily matter
From the bowel, whenever she had occasion to pass urine. The mere
straining during the act of urination
being sufficient to cause an escape
of oily fluid from the bowel. Under
the microscope, the fatty matter was
found to be perfectly structureless. The
faecal matter was pale in colour
and had an extremely offensive
smell. On cooling the oily
or oily matter floated on the sur-
fase in the form of a solid cake.
The greatest quantity found at
any time amounted to from eight
do nine ounces per diem. In this
case there seemed to have been ob-
trusely due to the absence of the pancreatic
secretion in the bowels. Thirdly, the
fatty matter may be present in the
bowels in the form of crystals, as
to exemplified in a case recorded
by Rich. In this case after death can-
ter of the pancreas was demonstrated;
the cancerous tumour having occupied
the common bile duct. The faecal mat-
ter during life was of a peculiar
silver-grey colour, and in common
analysis was found to consist of fat to the extent of half the solids. Microscopically the fat was present in great part in acicular crystals which were soluble in ether. The writer after commenting on the well known fact that fat in the stools is a common symptom of pancreatic disease, points out that the form in which the fat appeared in this case was unusual, as it could scarcely be detected without the aid of the microscope, whereas it as a rule occurs in amorphous masses easily recognizable by the naked eye. He assures by reference to cases recorded by Friedreich, Mortwag, and Gellhorn, that when fatty crystals are present in excess in the feces, that in addition to disease of the pancreas, there is also accentuation of the common bile duct. When obstruction of the bile duct is present jaundice with clay colored stools, and hypoproteinemia of the abdomen, are common symptoms. According to Wallace the same symptoms may however be observed in cases where the common bile duct is pervious, but the pancreatic duct occluded.
In support of this theory he narrates two cases, in which during life a diagnosis of obstruction of the pancreatic duct, with a healthy and natural condition of the common bile duct was made. The diagnosis was verified post-mortem. During life there was an absence of colour in the faeces. From these two cases he inferred that the formation of yellow bilirubin, the colouring matter of the faeces, depended on the mutual reaction of the bile and pancreatic fluid, under the influence of the intestinal tract. That in disease a deficiency of pancreatic fluid would, equally with a deficiency of bile, cause the pathological condition of colourless or clay-coloured stools. And that if hydrobichromic acid could not be produced without the aid of the pancreas, that organ must have an important role in regulating what proportion of the bile entering the intestines should be absorbed and what thrown off as the faeces." Another symptom attributed to a deficiency of the pancreatic juice in the bowel, but one which cannot be regarded as a reliable symptom is the presence of undigested pancreatic tissue in the stools. In connection with the
Urinary excretion of sugar in some cases is observable, the most reliable and important of which is the presence of sugar in the urine. To a greater or lesser extent, but as the presence of sugar in the urine may be dependent upon lesions in other organs, it cannot be regarded as being symptomatic only of disease of the pancreas. From the experiments of Mr. Murray and Mrkowskii in connection with extracts of the pancreas, there is no doubt that extensive pancreatic disease and the presence of sugar in the urine stand in relation to each other as cause and effect. Vaughan Hardy states that the excretion of sugar with the urine must be due to one of two causes—either excessive sugar formation or defective sugar assimilation. As there is in health an equilibrium between the amount found in the body, and the quantity assimilated by the tissues, it follows that anything which exerts this equilibrium, increases the quantity of sugar in the blood, and as a consequence leads to its appearance in the urine. As to the exact manner
In which this equilibrium is upset is still a matter of controversy, but that extensive disease of the pancreas does so, as shown by the presence of sugar in the urine, is generally admitted. The writer in the same article gives a table of twenty-four cases, in which after death the pancreas was found extensively diseased, and on which during life the symptoms of diabetes were more or less typical, while all the other organs in the body that may cause diabetes were found in a state of comparatively health. Out of the twenty-four cases, three were associated with cancer of the pancreas, and four with cirrhotic disease of the gland. The amount of sugar excreted daily in one of these cases varied from one to nine percent, and in some cases may reach even a higher percentage. The presence of such a volume of sugar in the urine causes an increase in the specific gravity, which may vary from 100 to 1060 or even higher. In every case the urine is acid, and is almost invariably greatly increased in quantity, amounting to eight, ten, or fifteen pints.
daily, and in some cases even more. In colour it is of a faint greenish tint, or clear like water. The amount of urea is increased, and in some cases phosphates and urates may be present. In the course of disease and later on when it is approaching to a fatal termination albumen may also be present. Minkowski states that if the strength fails or complicated actions appear, the amount of sugar diminishes and disappears before death in animals as in man. This statement is corroborated by Vaughan Harkey who says, "I further observed that in dogs and rabbits, as in man a noted diminution in the thyroid and polyuria takes place during the stage of cachexia and collapse, and not only so, but frequently the sugar entirely disappears from the urine at this period of disease." According to some observers fat may appear in the urine, as well as in the stools, and when present is seen either as oil globules, or as a greasy substance like butter, floating on the surface of the urine or its becoming cold.
In connection with the abnormal flow of saccharine urine, various other symptoms are associated, such as excessive thirst, abnormal hunger, emaciation, and general debility. These symptoms should be classed more properly as alimentary symptoms than as urinary, but since they being so frequently associated with the condition of glycosuria, it is perhaps as well to consider them in connection with, and as sequelae to that symptom. Thirst is often a well marked symptom, and when present is of such a nature that it cannot be quenched. It is owing in great measure to the want of fluid in the body, on account of the excessive excretion of urine. Hunger, or a constant craving desire for food is another and prominent symptom in some cases, but is not invariably present, and in the latter stages of disease may even be replaced by a loathing against food, especially in those cases where the patient is restricted to a diabetic diet. The digestion is as a rule fairly good, except in those cases where marked glyceric symptoms are present. From the deficiency
of fluid in the body generally, constipation of the bowels may be present, but on the other hand, as we have seen in connexion with the discharge of fatty matters from the bowels, diarrhoea may be present. As a result of renal assimilation of food, and the constant drain on the system by the kidneys, and bowels, when there is an excessive discharge of sugar in the urine and of fatty matters from the bowels, emaciation and general debility rapidly ensue. From weakness of the circulatory system, oedema of the limbs supervenes, and the skin becomes dry and scurfy. As a last stage, affection of the nervous system are prominent symptoms, as evidenced by extreme nervous fibrillation with attendant shivering, which gradually deepens into a comatose state, with subsequent collapse, which ends in death. The breath in glycosuric lies frequently a peculiar apple-like odour, and the respiration is accelerated. This acceleration of the respiration Vaughan Harley found to occur coincidently with the appearance of diacetic and oxybutyric acids in the urine, which acids, and acetone are frequently found in the urine shortly
before death, and are supposed to be the cause of the marked nervous symptoms. The exhalation of acetone from the lungs is supposed to give the characteristic apple-like odour to the breath in glycosuria. Some most striking symptoms are produced in cancersous and cystic diseases of the pancreas, owing to the effects produced by these new growths upon the surrounding organs and structures which lie in close relation to the gland. Of these symptoms jaundice of a permanent and extreme nature is often associated with these diseases of the pancreas, more especially so with cancersous disease of the head of the gland, the tumour causing obstruction of the common bile duct by pressure, and thus preventing the escape of bile into the bowel. As a sequel to the obstruction of the bile in the system, the general symptoms observed in connection with jaundice are specially produced, such as: - Flatus and distension of the abdomen, the appearance of clay-coloured stools, and bile in the urine, staining of the integumentary system and eyeballs, a feeling of languor, and general depression, loss of appetite.
manner, and the tumefaction and
irritating itching on the skin. Vaughan-
Harley mentions a case, in which a month
before the death of the patient, the skin
assumed an intense tint, which an-
ceased up to the date of death. On
autopsy, the skin was deeply jaundiced.
Immediately behind the pancreas and closely
adhering to the duodenum and some
earby was a tumour the size of the fist,
which implicated both orifices of the
bile and pancreatic ducts, and was
so adherent to, and embodied the
head of the pancreas, that it was impos-
sible to distinguish between its limits
and that of the proper pancreatic
tissue. On passing a sound into the
common bile duct from the duodenum,
it passed for about five or six centi-
métres, and then misranged on a
mixture caused by pressure of the
tumour upon the duct. Similar cases
are recorded by Vesleven, Sweeting,
Burchingham and Harley. In Vesleven’s
case, cancer of the head of the pancreas
with congestion of the bile duct was
found after death on examination.
During life the symptoms were-
abdominal pain, clay coloured stools, urine stained with bile, and contained sugar. Albuminuric was present during the last few weeks of life. In Suckling's case, in addition to the cancerous condition of the head of the pancreas, the duct was found dilated, and contained a large calculus; jaundice was a well marked symptom in this case during life. In Herringham and Keeley's case, jaundice was well marked also; after death, cancer of the head of the pancreas, including the bile duct, was found on examination. As we have seen in these four cases jaundice was a prominent symptom and well marked in each case. The physical effects produced on the liver seem to vary, in exclusion of the common bile duct. In all of these cases there was obstruction of the gall bladder and biliary ducts, but as regards the condition of the liver itself, there was a wide difference, as in Vaughan, Keeley's case, the liver was normal in size, in Suckling's it was small throughout, whereas in Herringham's and Keeley's it was enlarged. From these facts we may infer that in
occlusion of the common bile duct through pressure on its walls by cancerous oblitera-
tion of the head of the pancreas, dilatation of the gall bladder, or hepatic ducts, is a
common symptom, but as regards the condition of the liver, nothing definite
can be said, as it seems to vary in different cases. From the
close and intimate connection of the
head of the pancreas with the duodenum and pyloric end of the stomach,
ya new growth in the head of
the gland is very liable to produce
dilatation or these parts. Through pressure
or obstruction of disease to their walls,
or to produce obstruction, and narrow-
ing of the bowel through pressure,
as a result of obstruction or narrowing
of the bowel, or pyloric end of the stomach,
the passage of the contents of the
stomach, and bowel may be delayed
or arrested in their downward course,
and dilatation of the stomach with
obstructive chronic vomiting may ensue.
Pressure on the stomach directly, as
might be supposed, must gravely
interfere with its functions, and may
lead to diminution of its cavity. In other cases by extension of disease to its walls, adhesions of the leaves may follow, with subsequent ulceration and perforation of its walls, through the formation of a gastric ulcer. Vaughan Harley in the case of carcinous disease of the head of the pancreas, already quoted in connection with obstruction of the common bile duct, found on postmortem examination, ulceration in the duodenum and fistulous openings in its posterior wall. In connection with the diseased gland, associated with obstruction of the bowel, pain and vomiting are frequent symptoms. In a case recorded by Sjöman in which the head of the pancreas was entirely invaded by a serousous cancer, neither pain, nor digestive troubles were experienced till a month before death. The symptoms during the last month of life were—pain and vomiting, and ultimately obstruction of the bowel. In this case numerous secondary deposits of the disease were found on the glands of the abdomen, and also in the liver.
In a case of Gushni Rankei's, during life the symptoms complained of were repeated attacks of colic, accompanied by vomiting, imperfect digestion, weakness and progressive emaciation. On examination after death, the pancreas was found to be the seat of cancerous disease. The stomach was dilated, with unusually thin walls, and at the jejunum, the mesentery was thickened and indurated though no actual obstruction existed. Tabani records a case in which as the result of pressure by a cystic tumour of the pancreas, the stomach was diminished in size to such an extent that it could only contain an orange or two of fluid at a time. The symptoms were, partial obstruction of the bowels, after relief of which, dyspeptic symptoms and attacks of vomiting remained, until the tumour was treated surgically. Illustrative of the extension of cancerous disease from the pancreas are two cases, as follow. - The first of these is recorded by Hale White. In this case the symptoms through life were vague abdominal pain,
Vomiting, and wasting. On examination after death, the body of the pancreas was found to be the seat of a cancerous growth. The head and tail of the gland were normal, and free from disease. Adherent to the cancerous mass was a portion of the jejunum, which it consequence was found to be constricted and partially obstructed. Collier records a case in which, from calcarini of cancerous disease, and adhesion of parts, with subsequent ulceration, perforation of the stomach ensued. During life the patient had suffered from flatulence and dyspepsia for many years. Sudden, concurrent symptoms led to a suspicion of deep seated malignant disease. On post-mortem examination, a small and evidently recent perforation of the anterior wall of the stomach was detected. On the posterior wall opposite, was a cancerous mass. The size of a crown piece, this was found to be part of a scarious tumour of the head of the pancreas, which had become
adherent to, and had eaten away
part of the posterior wall of the
bursa. By the extension of can-
cerous disease of the pancreas,
other organs and structures at
a greater or lesser distance may
be infiltrated with, and correspondingly
symptoms be produced. In the
same manner cystic disease
may produce symptoms by exerting
pressure upon neighbouring parts
and organs. In extensive disease
of the pancreas, the blood
vessels which lie in close
relation to the gland, are
liable through pressure exer-
sed upon them by these tum-
ours to become obstructed, in
consequence of which, symptoms
of attended or disturbed circulation
manifest themselves. In the case
of the arteries, such pressure
may produce aneurysm of the aorta
pressed upon and obstructed, or more
frequently symptoms simulating those
of aneurysm, especially when the tumour
lies chiefly over the abdominal aorta,
in which case the pulsation of the artery
is transmitted to the Ammon’s, in such cases a distinct sound may also be heard or applying the stethoscope over the Ammon’s. The following two cases are instances where symptoms simul-
cating aneurism were well marked. The first occurred in connection with a
case of cystic disease of the pancreas in a man, and is recorded by Paul Swain.51
Between the umbilicus and the costal cartilage on the middle line of the abdomen
was a swelling about the size of an ordinary coconut. The swelling was
round, elastic, fluctuating, tense and smooth, and had well marked pulses
therein, which seemed to be expansible. On
percussion over the Ammon’s the note
elicited was dull, and on auscultation
a sound could be heard over a very lim-
ited area in the centre. The second case
is recorded by Lowe: in this case a firm
rounded Ammon could be felt in the
left hypochondriac region, this Ammon
was ultimately found to be a sarcoma
of the stomach and pancreas. Distinct
peristalsis in palpation, and a loud
on auscultation were detected, which
subsequent events showed must have
been transmitted from an artery through the bursa. The vein which later on comes in contact with the pancreas may either through pressure or by ex-omini of disease, become obliterated or closed by thrombosis, as a result of which various symptoms, according to the vein affected may arise, such as ascites, intestinal congestion and hemorrhage, enlarged spleen. In fact all the abdominal organs may be more or less affected according to the vessel affected, or remote symptoms may be caused as is illustrated in a case reported by Leonard Lane. The patient was a vagrant who after having several weeks was admitted, evidently in good health, to the casual ward of a workhouse. Before going to bed she complained of pain in one leg, which was swollen. In the morning she was found dead in bed. On making an examination of the body, there was found to have been caused by blocking of the pulmonary artery by a large blood clot. On further examination of the body, the pancreas was found much enlarged, hard on section, and
presented all the appearances of reiterbus cancer. The liver and spleen were also enlarged, and congested. The tumour of the pancreas on microscopic examination was found to be of the nature of reiterbus cancer. In commenting on this case, regards it as one showing the connection, as pointed out by Trenchard, between abdominal cancer and spontaneous coagulation of blood in the veins. From the history of pain in and swelling in the leg, the enlargement and congestion of the liver and spleen, and the fact of the pancreas being enlarged, and the seat of a reiterbus tumour, it seems more probable, that owing to pressure on the veins behind the pancreas, the clot had been produced through hemorrhage having occurred in the inferior vena cava. Having briefly considered the symptoms which may arise in connection with cancerous and cystic diseases of the pancreas, we will now turn our attention to considerations of the diagnosis of these tumours. The diagnosis of cancerous and cystic
obstruction of the pancreas is one of
great difficulty, partly on account
of the deep seated position of the pan-
creas in the abdominal cavity, and
the manner in which the gland is more
slapped, and surrounded by large organs
and important structures; and partly
on account of other organs and struc-
tures being so frequently implicated
and involved along with the pancreas
in these diseases. In the diagnosis of
these diseases, careful examination of
the abdomen is of the utmost
importance. In such examination,
apalpation and percussion of the ab-
dominal region should be practised,
as it is by these means that the
presence of a tumour may be
detected, and its outline and posi-
tion mapped out. In making
palpation, the patient should be
placed upon the back, with the thighs
flexed upon the abdomen, in order
to relieve the tension of the abdomi-
nal muscles. Deep pressure with
both hands, from before backwards,
during forced expiration should
then be made, and also laterally
from both sides over the region of
the pancreas. In order to detect any
enlargement of the gland, if present,
cancer of the pancreas, as we have
already seen, as a rule invades
the head of the gland. The
important condition then to be looked
for in cases where cancer of the
pancreas is suspected is a tumour
of the head of the gland. In such
cases, on deep pressure, a feeling
of undue firmness, resistance, or
iridescence, deep in the abdominal
cavity, at a level above the
umbilicus and a little to the right
of the middle line, may be
felt. On the examining hands, or
a mere or less definitely rounded
mass, firm and hard to the finger,
may be detected. In outline it may
be either irregular and nodular
or rounded and smooth, deeply
placed, as if it was rooted at the
base of the abdominal cavity.
According to Graham Brown, tumours
of the pancreas are unaffected by
the respiratory movements. To add
to the difficulty of diagnosis, where
a tumour can be detected, it is often impossible to be certain whether the tumour is one of the pancreas or of some neighbouring structure which may have become implicated through extension of the disease from the pancreas, or on the other hand may in like manner have implicated the pancreas. In connexion with the symptoms that arise from physical effects of disease of the pancreas, we saw that symptoms referable to the stomach and liver are frequently present. In forming a diagnosis of pancreatic cancer it is necessary to carefully discriminate between symptoms referable to the stomach and liver, as regards to the pancreatic disease, and symptoms referable to actual disease originating in the stomach and liver independently of the pancreas. In connexion with this point we must always bear in mind that symptoms of hepatic disease, as evidenced by jaundice, paroxysms of pain, and in some cases enlargement of the liver, may be caused by pressure
Upon and occlusion of the common bile duct by a cancerous tumour of the head of the pancreas, as in the same manner, dilatation of the stomach may be produced by pressure upon, and occlusion of the duodenum or pylorus. The diagnosis of pancreatic cancer must then be arrived at by a system of exclusion, and in cases where this system can be carried out, diagnosis will be greatly facilitated. As a general rule, serious disease of the stomach, liver, and other organs present distinct and diagnostic symptoms, which reveal the nature of the disease, and the part affected. Steele states that “in his experience cancerous deposits do not affect the neighbourhood of the gall bladder, and even when located close to it, only gradually, and then not absolutely obstruct it, whilst in seariness of the pancreas, the pressure of the growth does entirely obstruct the common duct.” From these observations he infers, that in cases, where extensive jaundice is a well marked symptom,
with absence of bile from the stools, urine deeply stained with bile, and
where neither gall stones, nor any
other cause can be detected, in all
probability the disease lies in the
head of the pancreas. In such cases
the gall bladder is dilated, and can
be felt by palpation. When such con-
ditions are present, more especially
when associated with some of the
more prominent symptoms of pan-
creatic disease, such as:—the pres-
ence of fatty matters in the stools,
sugar in the urine, deeply seeded
epigastric pains of a paroxysmal
character, progressive emaciation
and cachexia. The diagnosis of pan-
creatic cancer may be made with
certainty, but in other
cases, where prominent and well
marked symptoms are absent,
the diagnosis becomes extremely
difficult, or rather, impossible
of cancerous disease of the pancreas.
Cysts of the pancreas vary in size, and
also in position according to the part
of the gland from which they arise.
In size they may attain to such
dimensions that they are perceptible as a distinct swelling which may be readily felt and defined by palpation, and percussion of the anterior surface of the abdomen; such cysts are generally broader and more spread out anteriorly than posteriorly. Others, again, of these cysts may be broadened out and more closely attached to the pancreas; in which case they are broader posteriorly than anteriorly. To the hands or palpation cysts give the feeling of a deep seated, rounded, smooth, soft, and fluctuating tumour, which on percussion may be surrounded by a resonant area; the percussion note elicited over the tumour is dull. Cysts of the pancreas generally appear on the epigastric and umbilical region, in the middle line of the abdomen, as a rounded swelling, between the diaphragm cartilage and the umbilicus. This rounded swelling may extend across the middle line to the right, corresponding very much to the position of the head of the gland, and to the left may extend upwards behind the lower ribs into the left hypochondriac region, laterally and downwards into the left lumbar region. According to Krukenberg, a pancreaticic cyst is a retroperitoneal fluctuating cystic tumour, which comes forward
generally between the transverse colon and the lower border of the stomach, or it may also come forward above the stomach, or below the transverse colon. According to Jordan Lloyd these rumors never come forward below the transverse colon, which judging from the anatomical position of the surrounding structures seems more probable than the view advanced by Keeble. When the rumor presents between the transverse colon and the lower border of the stomach, according to Keeble, it is surrounded by an area of auscultation on percussion, taken above the stomach. The dulness of the rumor is continuous with, and is lost in that of the liver. The symptoms produced by cystic disease of the pancreas are in most part due to the pressure of the rumor upon the surrounding parts, and also from interference with the junctions of the gland. The diagnosis of cystic disease of the pancreas rests upon the presence of a rounded fluctuating, retroperitoneal tumor, which generally presents in the middle line of the abdomen, between the psoas muscle, cartilage, and the umbilicus.
and extends principally to the left side, lying above the transverse colon and below the lower border of the stomach, or it may lie above the stomach. In the former case, the rumour gives a dull note on percus-
sion, and is surrounded by an area of sympathetic resonance. In the latter case the dulness is lost in that of the liver on percussion.

Associated with these physical signs subjective sensations from pressure on the branches of the sympathetic nervus system, gastric disturbance, jaundice, and general wasting must if present be taken into account, and also the history of the case, especially where there is a history of previous abdominal injury. Espe-
cially, when the presence of fluid can be definitely made out, of the size of the rumour, and withdrawal of fluid by means of a hypodermic needle, though a dangerous expedient may in some cases be resorted to, as an aid to diagnosis. If the fluid thus withdrawn, gives evidence on testing, of the presence of it of a ferment which possesses the property
of converting starch into glucose, it is strong evidence in favour of the unusual benign of pancreatic origin. Minkowski draws attention to the fact that the diagnosis of cysts of the pancreas may be considerably assisted by distending the stomach with carbonic acid gas, and the colon with water, and observing the changes thus brought about on the position of the cyst. The diagnosis of pancreatic cysts owing to the number of diseases of neighbouring structures, and the similarity of symptoms presented by them, to those of pancreatic cystic disease must be a diagnosis of exclusion. The more common forms of disease in neighbouring parts, with which pancreatic cysts may be confused are: - Inflamed disease of the liver, cysts of the kidney and hydronephrosis, effusion into or collection of fluid in the lesser sac of the peritoneum, and aeurium. In cystic disease of the liver, the cyst causes either bulging of the right hypochondrium, or an elastic tumour presents either below or to
The left of the right lower ribs, and is in direct communication with the liver; the dulness on percussion is unaffected by change of position. On palpation on the right side a peculiar vibratory motion known as, hydralid fremitus, may be elicited. There is usually no pain, unless suppuration is going on in the biliary area. Kieser, mentions a case of epigastric tumor which was diagnosed as hydralid cyst of the liver. Change of position in this case cleared up the diagnosis, as when the patient stood erect, the tumour fell away from the liver, leaving a symmetrical area between it and the liver dulness. In cystic disease of the kidney and hydromephrosis the tumour lies in the lumbar region, and may extend upwards and downwards into adjacent regions, or it may extend forwards towards the anterior abdominal wall, and may be bilateral, both kidneys being affected. The color usually lies in front of, or it may be above the tumour, and is displaced and compressed.
so that constipation frequently co-
exists along with the disease. In
hydronephrosis, the tumour may
disappear suddenly, with discharge
of a large quantity of urine, of
a low specific gravity. In kidney
disease, other alimentary symptoms
are generally present, which indicate
the nature of the disease, or at least
assist in the diagnosis. In effumi-
des, or collection of fluid in the
lesser sac of the peritoneum, the
diagnosis between that affection
and pancreatic cystic disease is
one in which mistakes according to
Jordan Lloyd have frequently been made.
More especially so as the two condi-
tions may be present in the same case.
When we reflect upon the anatomical
relations of the pancreas, in connec-
tion with the lesser sac of the peritoneum
and that it is simply divided from
that sac by a layer of the
peritoneum, forming the pancreateal wall
of the sac, and the serous capsule
of the pancreas, we can readily see
how easily in the case of injury
a cyst of the pancreas, when present,
And bulging forward into the cavity may be ruptured, along with its peritoneal covering, and consequent effusion of its contents into the lesser sac of the peritoneum. This takes place according to Jordan Lloyd, effusion into the lesser sac of the peritoneum gives rise to a rumour, of a charaacteristic shape, which occupies the left hypochondriac, epigastric and umbilical regions, being broader below than above, and delineated on an irregular outline from side to side of the umbilical region. The rumour appears to vary from time to time in size and shape, according to the condition of the stomach, for when the stomach is full of liquid contents it increases the area of the rumour's dulness, and when distended with gas, the dull area becomes resonant, and apparently the rumour may disappear altogether. In addition to these physical signs he found that there was dulness posteriorly over the lower ribs in percutation. This he attributed to gravitation of the fluid, as the
cavity of the lesser zone of the pericardium reaches deeply backwards to the left of the lumbar vertebra, as far as the base of the abdominal cavity, opposite the fourth lower ribs. From pressure of the underlying lungs the head may be displaced upwards, so that the apex beat is located in the fourth left intercostal space. Barnett reports a case which appears to bear out and corroborate Jordan's views. A labourer was enfolded between a gate post and a wheel. After recovery from the injuries then sustained, he became thin, weak, and dyspeptic. Nine weeks after the accident, as there was evidence of thoracic effusion reaching as high as the eighth rib on the left side, the chest was aspirated in the infra-clavicular region, and eight ounces of turbid fluid drawn off. A week later, a slight rounded elastic prominence was observed in the epigastrium region, which elicited a dull note on percussion. This prominence was aspirated, but
returned, and ultimately laparotomy was performed. A large cyst was then exposed below, and to the right of the stomach. The cavity extended back to the vertebral column, and on the left side, deeper than could be reached by the exploring finger. The fluid contained a starch curdling ferment. In aspirating the chest in this case the needle had evidently pierced the diaphragm, and entered the abdominal cavity and lesser sac of the peritoneum.

Jordan Lloyd in the paper lately quoted says, "The dulness over the left lung ribs posteriorly is an interesting sign. The cavity could easily be tapped by a needle introduced from behind, and might give rise to the belief that the fluid was in the pleural cavity." A pancreatic cyst when placed over and in contact with a large vessel like the abdominal aorta may have a distinct pulsation communicated to it from the artery, thus simulating an aneurism. The pulsation may seem to be
expansile, and on auscultation a distinct bruit may be heard over the swelling. Paul Macani records such a case, in which however he found that on pressing the hands deeply in on each side of the cyst, and drawing it forward, the pulsation became less marked. As a rule the bruit so be heard over cystic aneurysms which anucleate an aneurysm can only be heard over a very limited area in the centre of the aneurysm. In cases where aneurysm is present, other circulatory disturbances help to make the diagnosis of aneurysm certain. From what we have seen in connection with carcinous and cystic diseases of the pancreas, more especially in connection with the former, it is evident that positive diagnosis of these diseases is a matter of great difficulty, and often impossibility. In all cases then, where, from concomitant symptoms, either of these diseases is suspected or throughout examination of the abdominal cavity, and its organs
should always be made. And re-
peated again and again if need-
ecessary, for we must always bear
in mind that symptoms indicating
disease of the pancreas, by influence
with, or suppression of its functions
may be present for a long period
before any actual tumour of the
 gland can be detected.

The treatment of cancerous and cystic
diseases of the pancreas may be divided
into two sections, namely:—medicinal
treatment, and surgical treatment.

Medicinal treatment in cases of
cancerous and cystic diseases of the
pancreas is purely palliative, as there
is no chance of any cure being effected
by means of drugs, and like all other
forms of palliative treatment must
be directed to the relief of symptoms
which arise during the course and
progress of these diseases. Pain, as we
have already noted, is one of the most
urgent and distressing symptoms, es-
specially in cases of cancerous disease
of the gland. For its relief, morphia
is the most useful and reliable remedy
we have at our disposal, and is best
used on the form of hypodermic syringe.

In addition to the use of morphine, warm fomentations, poultices or swab- 
aves, applied over the seat of pain, often give relief. In cases where there is evi-
dence of inflammatory action, or of hemorrhage, cold applications, of which 
see no the most suitable may be applied. For the relief of digestive 
disturbances, which are so frequently 
associated with diseases of the jenius, 
the various drugs commonly used in 
cases of stomachic arrangement are 
prescribed, such drugs as: - soda, 
biuret, hydrocyanic acid elixirs, 
quinin in some form, and others. In 
persistent vomiting, counterirritation 
over the part of stomach often assists 
in checking this troublesome and 
painful symptom. For the relief of 
persistent thirst, when present, 
nothing as a rule is so efficacious as 
the sucking of small pieces of ice, 
or the administration of lemon juice 
in water or effervescent waters, and of drugs, such as: - dilute phosphate 
acid well diluted in water may be 
tried. In many cases the use of
saline aperient remedies, or mineral waters, especially in those cases where constipation is a marked and troublesome symptom gives relief, not only on account of the laxative action on the bowels, but also on account of their, at the same time unloading, and relieving the circulation of the liver. The marked evacuation and debility so common in these cases must be treated, by means of suitable nourishment of a light and sustaining nature, and by the use of stimulants where these seem to be called for. When sugar is present in the urine the diet must be restricted to ordinary diabetic regimen, and medicinally open in some form, of which codliver is generally acknowledged to be the most suitable, administered. We have already cited the various actions of the pancreas, the juice in food stuffs in the bowels; also the now generally accepted theory that the pancreas in addition to its so-called external secretion, secretes another, a so-called internal secretion which passes directly into the circulatory system. From the experiments
of Minkowski, and others, we have seen, that when the secretions of the pancreas are interferred with, either by removal of the gland, or by any means which produces such extensive changes in the gland herself that it can no longer carry on its natural functions, certain well-marked symptoms present themselves in the animal economy, such as:—

an increased flow of urine, which contains sugar, the appearance of fatty matter, and undigested food in the evacuations from the bowels, associated with general weakness and emaciation of the body. As these symptoms are known to be due to the want of a definite and known substance in the body, it has been suggested that the reintroduction into the system of some substitute for this substance, from without, should have a beneficial effect upon the symptoms and course of the disease. The substitute suggested, and hitherto used, has been the fresh pancreas of sheep or oxen, or an extract prepared from it. The methods on which this
substitute has been used are various. Having been in some cases introduced directly into the stomach, either in
the form of fresh pancreas or extract of pancreas or the food has been pre-
digested by means of an admixture of pancreatic juice or extract before
being taken into the stomach, in the hope that by these means digestion
would be accelerated, and the substance thus introduced into the stomach be
absorbed, and seeking the place of
the wanting secretion of the pancreas
have a beneficial effect. Ligation
createrinus has in other cases been
injected under the skin, in the hope
and anticipation that it would
thus pass directly into the circula-
tion, and then replace the so
called internal secretion of the pancreas. Reaching from the results of
Minkowski's experiments on trans-
planting and grafting portions of
the pancreas in the abdominal cav-
ity, it has been essayed to graft
portions of freshly killed sheep's pancreas into the subcutaneous tissues
in various parts of the body.
suggests that in the treatment of pancreatic diabetes, fresh uncooked pancreatic extract should be administered by the rectum, or if necessary through the saccal veins instead of by the mouth or hypodermically. The reason for suggesting this course is, that the extract has been administered with little success, as we shall presently see from recorded cases, in which the treatment has been really applied. This want of success he suggests may be due either to the fact that the secretions of the stomach neutralise the products of the pancreas, or may be due to the fact, that the sugar containing element in the administered pancreas, or extract of pancreas, instead of entering directly the portal vessels, is absorbed by the lymphatics of the alimentary canal, and so passes into the general circulation, and is subsequently destroyed. For the same reason, he suggests hypodermic injection of pancreatic solution would probably be useless. By injection into the rectum, or saccal veins, the pancreatic
extract would be conveyed to the liver. This theory he bases upon a paper read by M. Katsmam before the Société des Sciences, Paris, in which he states that by experiment he has proved that the internal secretion of the pancreas in dogs has an inhibitory influence on the formation of sugar in the liver. He has proved that this influence is exerted not merely through the nervous system, but through direct action on the liver cells. The difficulty as regards rectal administration is also open to protest, but the fact that the pancreatic extract would thus, as in the stomach, and when injected hypodermically be absorbed by the lymphatics, and thus be carried into the general circulation. To obviate this, he proposes that a quantity too large for the lymphatic vessels to take up, should be injected at once, in the hope that some of the extract might find its way into the capillary vessels, and from thence pass into the portal vein through the inferior mesenteric venus, and thus be carried to the liver.
Failing the above method he proposes that the pancreatic extract should be injected by means of a hypodermic needle, into the subcutaneous tissues of the arms or rectum. As this latter method would not be free from danger, he concludes by suggesting that before the injection of pancreatic extract into systemic veins, its effects should first be assayed on animals. Rule White in an article on the treatment of diabetes by feeding on raw pancreas, and the subcutaneous injection of liquor pancreasies, gives the account of two cases in which the above treatment was tried. During the whole period of the experiments the patients were kept on a strictly diabetic regimen, and had no drugs administered to them. Having ascertained the state of each patient, and of their urine, on this diet, they were given each night for supper about two ounces of raw fresh sheep's pancreas, chopped fine, and flavoured with salt and pepper. Later on this was discontinued and fine mince of
Liquor pancreaticea injected hypodermically night and morning. The results obtained he has tabulated under the following headings.

Sugar.

In one case, no raw pancreas. The amount of sugar was distinctly less than it was before. The same result being observed, but in a less degree when liquor pancreaticea was injected hypodermically.

In the second case, neither remedy had any effect in reducing the amount of sugar.

Urine.

In neither case was there any decided effect upon the quantity or specific gravity of the urine.

Very little or no effect upon the amount of urea excreted.

Effects on general condition of patients.

He says: "We may, I think, conclude that the patients do not lose weight when treated with the pancreas, perhaps they gain a little, and if there is any other alteration, they feel a little better for the treatment."
Disadvantages of the Treatment.

After six days treatment by administration of raw pancreas, the first case suffered from a severe attack of erythema, accompanied by fever and sore throat. During the septic attack the sugar fell very low. The second case had no rash, but on the seventh day of administration he suffered from fever and sore throat.

Conclusions.

From the results quoted, it is very doubtful whether feeding on raw pancreas, or the hypodermic injection of liquor pancreaticeus have any beneficial effect. Neither appear to have any effect on the quantity of urine, specific gravity, or amount of urea. Perhaps they decrease the amount of sugar, and very slightly increase the weight and strength of the patients, but a decided disadvantage is that it may cause severe erythema with fever and sore throat.

Wearin Williams gives the history of two cases of diabetes treated with pancreati extract, one of which was subsequently treated by grafts of sheep's pancreas.
In the first of these two cases, the patient, a boy of fifteen years, during the whole period of treatment was restricted to diabetic regimen, and during part of the nine codenae was also administered. Freshly minced pancreas was used, and in addition, liquid extract of pancreas was given both by the mouth and under the skin. At the end of the first week, there was a marked improvement. The amount of urine, sugar, and the thirst have all distinctly decreased. The improvement was however merely transitory, and at the end of seven weeks' treatment, the patient was in the same state, or even worse, than at the commencement of the treatment. Three months later, transplantsing grafts of sheep's pancreas under the skin of the patient was essayed. Three portions of pancreas, about the size each of a Brazil nut were taken from the pancreas of a newly killed sheep, and grafted, with as little delay as possible, into the subcutaneous tissues of the breast, and abdomen of the patient. The whole operation being performed under strict
antisepic precautions. Three days after the operation, the patient died suddenly. On necropsy the pancreas was found small and shrivelled in appearance. Sections of the gland showed that almost all the secreting structure had disappeared, and the gland was little else than a fibrous stroma. The grafts of sheep's pancreas had failed to unite with the surrounding tissues, and were found on microscopic examination to contain micrococci. In the second case, the patient was also treated with pancreatic extract by the mouth, and hypodermically, all the same time being kept on diabetic regimen, but without any amelioration in his symptoms following upon the treatment. Drownley Sibley gives details of a case of diabetes in a policeman, who when he first came under his care was in a very feeble and emaciated condition. The treatment prescribed was diabetic regimen, and fresh pancreas by the mouth. The juice of the gland was to be squeezed out and drunk raw.
the gland to be slightly cooked and eaten. Under this treatment the general health and appetite improved, weight was gained, the amount of urine passed on the twenty four hours was diminished, but the amount of sugar in the urine did not appear to have decreased. 

Hector W. G. W. Kinkley mentions two cases of diabetes treated by bumi with pancreatic juice by the mouth. The amount given was half an ounce three daily immediately after food. In both cases the patients improved under the treatment, having lost to a great extent the feeling of lassitude complained of before treatment. Their general condition was improved, thirst was a less distressing symptom, and the quantity of urine was also decreased. The specific gravity of the urine, and the amount of sugar it contained remained however unaffected.

Nelle Wood in two cases treated by bumi with pancreatic extracts found in the first case that the patient who was restricted to diabetic regime
and treated with gymmni, and cathily
with pancreatin pills coated with keratin, improved under treatment.
His general condition and weight improved, thirst diminished, the amount of urine and its specific gravity decreased, as did also the amount of sugar. In the second case, the treatment carried out was similar to that in the former case. The patient improved in general health and weight, but complained of increased thirst; the amount of urine remained unchanged, while the quantity of sugar contained in it increased. Kornann records the case of a man who suffered for many years from diabetes. The amount of urine passed daily was about 3,600 c. em., with a specific gravity which ranged from 1035 to 1048, and in which sugar was excessive to the quantity of 400 g. Dietetic treatment, combined with opium, aperient, and saline enemata of bismuth, slightly diminished the quantity and specific gravity of the urine, and the sugar decreased.
was reduced to 30 to 110 daily. In spite of this improvement, however, the patient lost weight. Pancreas was then prescribed, and was given in the form of one fresh and pancreas roasted, daily. This treatment was carried out for one week, at the end of which time he complained that he could not continue eating the pancreas. The juice of half a gland was then expressed, and daily injected into the rectum.

Ten days later, pancreas extract was substituted, and injected hypodermically, to the amount of 140 cc. daily. After five weeks treatment by pancreas administration, it was found that the quantity of urine was greatly diminished, and the excretion of sugar had fallen below 30 daily. The general health and strength was improved, weight increased, and thirst diminished.

He points out that: "The treatment of diabetes with pancreatic extract has hitherto been productive of no very striking results, still, he thinks that if the literature of pancreatic
Therapeutics could be brought into line with that of thyroid treatment, and the method thus placed on a physiological basis, an effective and constant preparation might be obtained and employed. From the record of these cases it would seem that the treatment of the symptom, glycosuria (whether it arises, and is caused from disease of the pancreas, or from other causes) by means of raw pancreas, or pancreas extract, however administered, is extremely uncertain, and in the great majority of cases gives negative results with regard to the diminution of the amount of sugar excreted in the urine. The only advantage gained by this line of treatment seems to be that the general health and strength is slightly improved, which although no great result is always something when we remember and consider the great waste from the system that is constantly going on, by the loss of the sugar obtained and excreted from the body in the urine.
The surgical treatment of the pancreas is practically confined to cases of cystic disease of the gland. From the deep position in the abdominal cavity, the close connections and relations of the pancreas with surrounding structures, and the fact that cancer of the pancreas is so frequently secondary or due to extension of the disease from surrounding structures, the operation seems to be hardly justifiable, especially as cancerous disease is so liable to occur if the diseased parts or tissues are not wholly removed. In a glandular structure like the pancreas, the operation to be a radical cure, would necessitate complete removal of the gland, which operation according to Sum, always terminates fatally. The operation has however been performed. And Hillard is reported to have successfully removed a cancer of the pancreas. Surgical treatment may with advantage be resorted to in certain cases of cancer of the pancreas, for the relief of symptoms caused by pressure upon surrounding parts, by the tumour, as for instance:-
where either through pressure upon, or esculcation of the disease to the common bile duct, the outflow of bile from the gall bladder into the bowel is arrested, and symptoms of jaundice, with discoloration of the bile ducts, and gall bladder, ensue. Steele, in such cases suggests as a means of alleviation of the discomfit caused by jaundice, “super evening, during the course of pancreatitis, cancer, and as a means to lengthen life for a short time, that a permanent fistula should be established between the gall bladder and the external surface of the body. By cutting down upon the gall bladder, giving it to the skin, and opening it, and thus draining the bile from the system, and so alleviating the jaundiced condition of the patient. This operation has in such cases been performed by Termer, Mayo Robson, and others, but by them is not regarded favourably on account of the great tendency to hemorrhage. Mayo Robson in two such cases found the hemorrhage from the internal punctures to persist, and recidive...
treatment for many days. This tendency to hemorrhage in these cases, he concludes to be peculiar to distension of the gall bladder, as a result of obstruction of the common bile duct by a cancerous tumour of the pancreas, as he has never observed the same complication in jaundice from gall stones; and that it is caused either by the presence of malignant disease, or by interference with the proper function of the pancreas. Moreover, judging from the good results obtained in joining an anastomosis between the bile duct and small intestine in certain cases, suggests that a similar procedure might be carried out in cases, while the duct of Wirsung becomes obstructed and dilated through cancerous disease of the head of the gland, and that the best method of doing so, would be by the intervention of Murphy's button. Owing to the uncertainty connected with the diagnosis of such a condition, this proposed line of surgical treatment, though feasible to all appearance,
presents too many difficulties and uncertainties to be of yet of any value. From the foregoing remarks it may be inferred, that little more than alleviation of symptoms, and a short prolongation of life, can be possibly looked for as a result of surgical treatment, in cases of cancerous disease of the pancreas.

When however the operation is essayed, the method of procedure in exposing the pancreas is, as follows:—an incision is made in the middle line of the abdomen, commencing two or three inches above the umbilicus, and extending if necessary round that point, and below it. By means of this incision the abdominal cavity is opened; the stomach, great omentum, and transverse colon are then drawn upwards, and maintained in that position. The inferior layer of the transverse meso colon is then divided, after which the pancreas must be dissected of the superior layer of the ascending Jejunum of the transverse meso colon, which constitutes the peritoneal covering in front of the pancreas.
In the course of these various steps of the operation, cell blinding vessels must of course be secured. In cystic disease of the pancreas, surgical treatment gives good results, and it is to this form of pancreatic disease, as already stated, that surgery of the pancreas is practically confined. Various methods of surgical treatment in pancreatic cystic disease have been essayed and practised by surgeons. These methods may be divided into three groups, as follows:—Excision of the cyst, aspiration of the cyst, with or without the subsequent injection into the cyst cavity of medicine, or some such drug, with a view to settling up inflammatory action, and thus causing obliteration of the cyst by adhesion together of its walls. Excision and drainage of the cyst. Minz in the article already quoted suggests a fourth method, as a possible line of surgical treatment in the future, as follows:—Owing to the close anatomical relations of the pancreas and the duodenum, he
suggests that it may be found feasible to drain pancreatic cysts into the bowel. Excision or dissecting out of a pancreatic cyst as may be suffered from the deep seated position of the gland, the important organs and structures with which it is surrounded, so intimately connected with, and covered by, would render this operation one of great delicacy and difficulty. Ziegman is reported to have succeeded in dissecting out a cyst of the pancreas with favourable results, but with others this operation has hitherto been unsuccessful. Kreeke states that excision of the cyst would appear to be accompanied by very considerable risk, for out of six such cases, three died. From these statistics, the results hitherto obtained by this line of treatment do not appear to have given satisfactory results. Aspiration or tapping of pancreatic cysts judging from the favourable results obtained in connection with similar treatment of effusions into various other cavities in the body.
And the facts that in pancreatitis and cystic disease, there must always be an element of uncertainty as to the limitation and attachments of the cyst, and also that the operation can be carried out with so slight a disturbance of neighbouring parts, would seem to be indicated as a simple and safe means of removing the contained fluid from the tumour. But that it is not so, has been proved by experience, more especially so, in these cases, where after rapping, iodine, or any other irritant drug has been injected into the sac, with a view to cause obliteration of the tumour. In such cases the risks of setting up peritonitis are great, and fatal results have been known to have ensued from this cause after the above treatment has been essayed. Aspiration, without any subsequent injection into the cyst cavity, is also by no means such a simple and safe operation as it would appear to be. Serious complications have arisen after aspiration, owing no doubt
To rupture of the cyst wall, and escape of fluid into the peritoneal cavity. Such a case is recorded by Ballhead, where a boy, who had been run over, developed some months later a swelling in the abdomen. As fluid was observed in the swelling, Mr. Ballhead made an exploratory puncture with a subcutaneous syringe and drew off a syringe-full of dark brown fluid. Almost immediately afterwards, the boy complained of acute abdominal pain, and soon became collapsed. On laparotomy being performed, the abdominal cavity was found to contain a large amount of fluid, similar in nature to that withdrawn by exploratory puncture. And on passing the syringe deeply into the cavity, a collapsed cyst was found in the neighbourhood of the pancreas. There seems no doubt that in this case, the alarming and serious symptoms which followed the exploratory puncture were caused by rupture of the cyst wall, and effusion of its contents into the
abdominal cavity. That such serious results do not always follow upon aspiration of pancreatic cysts is well known and proved by the number of cases recorded, in which after aspiration no serious symptoms have ensued; but aspiration in these cases has proved to be no radical cure of the disease, as the cyst has been generally found to refill sooner or later after the operation. Simpkin, records a case of Professor Amundsen, in which a cystic tumor of the pancreas, in a female, was aspirated, and about thirty ounces of blood stained fluid withdrawn. But in a year’s time the patient returned to hospital with the cyst refilled. Barnett, records a similar case, where aspiration was performed four times in the same case, with subsequent refilling of the sac after each aspiration. Theodore Fisher also reports a case of sanguineous cyst in connection with the pancreas, from which he removed by aspiration about thirty ounces of dark brown fluid, after which the sac rapidly refilled.
In all these cases further surgical treatment had to be resorted to, in order to effect a cure of the disease. From the record of these cases, aspiration, as a radical cure of pancreatic cystic disease, seems to be of little value, and has been abandoned for the third method mentioned, or more radical operation of resection and drainage of the cyst. This operation has been found to give the best results, and at the present day is the recognized surgical treatment of pancreatic cysts. Kreeke says, "The results of treatment by drainage have been very good. A fistula occasionally remains, but this will usually subsequently heal up. Out of twenty seven cases thus treated, all recovered." The operation, according to Keith, is performed in the following way:—An incision two or three inches in length is made over the tumor in the middle line. When there are no adhesions in front, the membrane is seen as soon as the peritoneum is divided, and is cut through with...
seizers, all bleeding points being tied. The crown, preferably attached to an aspirator as the fluid may be thick, is thrust into the case, as soon as the fluid is expelled, the case wall is drawn through the outside wound and connected to it by stitches, as much of the case being removed as can be done without causing tissue. Should firm adhesions exist at the start, the incision is made down to the case, and the contents removed by the aspirator. The opening is made of sufficient size to admit a large drainage tube, and the adhesions tube the place of stitches. It is better not to attempt to remove any of the cyst wall in adherent cases. A large eyed drainage tube is to be used in every case, and a second if necessary, should there be any patch. At first there may be free discharge, which will be apt to cause deglucia of the skin if the cyst have been caused by a blocking of the pancreatic duct. In such a case, some greasy substance must be applied round the wound.
As the drainage lessens and the cyst closes up, the drainage tube which may have been reduced in calibre so as to be gradually shortened. The fistula may or may not remain permanently. That this treatment gives good results, and is successful in most cases of pancreatic cystic disease is shown by the following case, although much as we shall see later, in certain cases urges objections against this line of treatment, as regards the opening of the abdomen in fact, and proposes that in certain cases, and for certain reasons the cyst should be excised and drained from behind. In the case already noticed, in which Professor Annandale aspirated the cyst, visceri and drainage was ultimately resorted to, in the cyst refilling. The cyst well, after opening the abdomen in the middle line above the umbilicus, and cutting through two layers of peritoneum, was exposed, and was found to be thickened and cicatrized. The cyst wall was then carefully entered all round the
margins of the wound and antiseptic-
cally dressed. A month later firm
adhesion having taken place, the
cyph was punctured and then incised,
a large drainage tube being inserted.
Free discharges continued for one
week, after which the tube was
shortened. The discharge gradually
diminished, and saline was injected
twice. When the patient left the hospital
about a month later, the discharge
had almost ceased, and she was in
perfect health. In Mr. Cathcart's case
where serious symptoms followed,
owing to rupture of the cyst wall
after exploratory puncture, abdom-
nal section was performed within
a few hours. In this case owing
to the collapsed state of the cyst,
its walls could not be stitched to
the external wound, but as it was
found on recannICATION to stick
well far into the left hypochondriac
region, a counter opening was made
on the left side, and the cyst drained.
Both wounds healed well, although
the fluid discharged from the second
wound was found to be irritating to the
Skin around the wound. Paul Swan reports a case operated on by himself in which an opening the abdominal cavity the omentum and mesentery bulged into the wound, and turned up. As the suture could not well be reached from below the omentum was again reduced into the abdominal cavity. The abdomen was then drawn down to the left, and the wound at once bulged forward above, between it and the liver. Absorbent sponges were packed round the wound and a small drain made to pierce its wall, by which the fluid was removed. The eye was deeply placed, and owing to the brittleness of its walls, some difficulty was experienced in bringing it far enough forward so as to enter it to the abdominal wall, in the upper angle of the wound. A Keith drainage tube was inserted. The patient recovered well, and the wound healed without any trouble. During recovery difficulty was experienced through the wound healing so close in the middle, leaving a Jew's knot, posteriorly, in which effusion collected. From the history of this case it seems probable that a cyst of the
The pancreas had excited, and had been ruptured, and effusion of its contents into the lesser peritoneal sac had occurred. Dr. Parrutt's case caputting was performed, and a large cyst exposed to the right of and below the stomach. The cyst wall after aspiration was stitched to the abdominal wound and drained. The patient made a good recovery. John in a case operated on by himself, opened the abdomen above the umbilicus, but found that the incision had subsequently to be prolonged around and below the umbilicus. The stomach, duodenum, and transverse colon were found stretched over what was evidently a large collection of fluid. On drawing the duodenum and colon upwards out of the wound, a large cyst was exposed. On aspiration and incision four and a half pints of fluid were removed. "It was then treated," he says, "as one usually treats a ruminal, i.e., the anterior wall was excised." No drainage was employed after the operation, and the patient with the exception of some abdominal disturbance
The day after operation, made a good recovery. Four months later he was in good health, and the tumour showed no signs of re-appearance. In the case reported by Theodore Faber in which as already mentioned aspiration was followed by rapid resiling of the cyst, abdominal section was resorted to. In this case as the tumour was situated on the left side, an abdominal incision two and a half inches long was made over the tumour in the line of the left linea semilunaris. The cyst in being exposed, was found to be adherent to the abdominal wall, it was opened and drained. About six ounces of dark coloured fluid being drawn off. Eight months after leaving hospital the patient was in good health. And the wound had completely closed. Kuster gives particulars of a case of cystic disease of the pancreas in which after abdominal section and exposure of the cyst, the one was aspirated and opened. The wall of the one was then stitched to the abdominal wound. The patient made a good and steady recovery.
Still, as we have already stated, urges certain objections against a
steady and fixed rule being laid down, as regards the surgical treatment
of pancreatic cysts by anterior abdominal sections, and says that
in his opinion, many of these cases would be better treated, and give
better results, by being operated on from behind, and the cyst drained
posteriorly. His reasons for urging
this course are as follows:—Although
anterior sections of the abdomen, and
drainage of the cyst gives good res-
results, it does not always result
in a cure, and the fistulous open-
ing necessary in the operation may
not heal up. He cites a case reported
by headquarters in which the fistulous
opening did not heal up, and in
which a cancerous tumour closely
copied around it. From the different
shapes of pancreatic cystic tumours
he urges that in cases where the cyst
is movable and comes forward to the
anterior abdominal wall, anterior
section and drainage is the most
suitable form of treatment, especially
as in these cases, the tumour is frequently broader anteriorly than posteriorly, but in these cases where the tumour is deeply placed in the posterior part of the abdominal cavity, and, as is frequently observed in connection with these deep seated cysts, is broader posteriorly than anteriorly, posterior venous and drainage, he argues, give the best results. In these cases this seems quite natural, as owing to the position and nature of the tumour in the body, drainage from behind must be more efficient, and more easily managed than when the opening is situated on the anterior surface of the abdomen. The stretching, with risk of tearing the cyst wall, in order to enlarge it to the external wound on the anterior surface of the abdomen is also in these cases obviated through posterior venous and drainage. He further states that the anterior abdominal operation confuses with the natural usefulness of the abdominal walls. The operation for posterior access and drainage of parametrial cystic tumours is described by Leith, as follows:—
A vertical incision about three inches long is made at the outer border of the left rectus muscle, beginning above at the twelfth rib. After cutting through the skin and fascia, the thin fibres of the latissimus dorsi are first recognised, and then the strong fascia at the outer border of the rectus. This is incised and the upper border of the quadratus lumborum is next seen running down vessels and outwards. The finger is inserted above it, and feels for the posterior surface of the kidney through the fat and cellular tissue. It then defines the position of the renal vessels. The tail of the pancreas, and the posterior lateral wall of the lesser omental sac lie just above and inside them. The cyst may be reached either from below or above the renal vessels, and when reached must be treated by incision and drainage. This operation as a means of treating cysts of the pancreas has been successfully performed by Mr. Robertson of Edinburgh, Royal Infirmary. In cases, such as that recorded by Paul Swami, where
great difficulty was experienced in bringing the cyst walls forward to the edges of the wound on the anterior surface of the abdomen, for after the operation the sinus showed a tendency to contract in its middle, thus forming a perforated pouch in which effusion collected; and in cases, where owing to injury of a cyst of the pancreas, rupture with consequent effusion of its contents, into the lesser sac of the peritoneum takes place, such lines of surgical treatment would have manifest advantages; in the first case, as regards the difficulty of bringing forward the walls of the sac, in order to suture them margins to the edges of the anterior abdominal wound, and the management of subsequent drainage; in the second case, as regards the free drainage of the ruptured cyst, or collection of fluid in the lesser peritoneal sac, which sac, as we have already seen, extends deeply towards the posterior surface of the abdomen to the left of the spinal column, in which
It could be easily reached, and thorough and efficient drainage established. As in all cases of cystic disease of the pancreas, diagnosis as to the nature, origin, and size of the cyst can only be of an imperfect kind, until laparotomy has been performed, and the cyst exposed, it is impossible to lay down any hard and fast lines as to which form of operative treatment is best suited to individual cases. As both lines of treatment are practicable, and give good results, there seems no reason, in cases where an anterior abdominal section, it is found that the tumour is so shaped, or too deeply placed for closure of the walls of its sac to the edges of the anterior abdominal wound, why in such cases a counter opening should not be made behind the sac thus cleansed posteriorly, and the anterior wound closed. In concluding our remarks on the surgical treatment of cystic disease of the pancreas, we can not do better than by quoting some...
of the conclusions arrived at by Jenni, as a result of his researches concerning the surgery of the pancreas. These conclusions are eight in number, and are, as follow:—

1. Complete excision is always fatal.

2. Partial excision is feasible and justifiable.

3. Gradual atrophy of the pancreas is not incompatible with health.

4. Extravasation of fresh normal juice into the peritoneal cavity is promptly absorbed, as is also crushed or lacerated pancreatic tissue, if aseptic.

5. Limited detachment of the mesentry from the duodenum, as required in pancreatic operations, is not followed by gangrene.

6. In operations on the head of the pancreas, the duct should be left in physiological connection with the tail of the gland.

7. The formation of external pancreatic fistula by abdominal section is indicated in cases of cysts, abscesses, gangrene, and hemorrhage into the pancreas from a local cause,
ni preference to excision as practised by Reidel and Welbore. When an
anteroseptal incision cannot be formed, bimanual drainage should be estab-
lished.
37. Removal of impacted pancreatic
calculus in the duodenal extrem-
ity of the duct by linear or incision
should be practiced when the com-
mion bile duct is compressed by
the calculus, and in such cases
extravasation of bile may be
avoided by preliminary aspiration
of the distended bile ducts. The
chief difficulty is the diagnosis,
but this can for the most part
be accomplished during the first
stage of any operative inver-
ceedure.
References.


Page 44. *Epitome Britisch Medical Journal*. March 25*°* 1892.


(Boulaard) *Epitome Britisch Medical Journal*. April 25*°* 1891.


Page 253.


(Boulaard) *Epitome Britisch Medical Journal*. Sept. 1891.
   March 18^2 1893. Page 530.
   January 11^2 1893. Page 64.
   January 14^2 1893. Page 68.
   Page 426.
   Page 1291.
   Chapter 5. Page 312.
03. Cathcart British Medical Journal. 
    July 22nd 1890. Page 426.
08. Krüger Medical Chronicle April 1887. 
    Medical Annual 1888. Page 887.
    Pages 781 to 787.