

AN INSTANCE OF PANCREATIC BLADDER IN THE CAT

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ONE FIGURE

In the January, 1910, number of the *Anatomical Record*, W. S. Miller calls attention to the few recorded observations which have been made upon the occurrence of pancreatic bladders. These apparently anomalous structures have been seen only in *Felis domestica*, and but rarely. The pancreatic reservoir bears, when fully developed, the same anatomical relation to the pancreas that the gall bladder does to the liver, and doubtless functions in the same way, that is, by acting as a reservoir in which the secretion accumulates until it is required for digestion. At any rate, this view is supported by the facts detailed later in this paper in the description of the author's specimen.

Seven other examples of this structure have been recorded so far. Mayer described one in 1815, Gage one in 1879, and Miller a total of five between 1904 and 1910.¹ The specimen which forms the subject of this paper was found in a full-grown female cat. After being etherized for another purpose, its abdomen was opened for inspection and there was noticed a cystic structure lying adjacent to the gall bladder. Later, after the nature of the cyst was apparent, a careful dissection of it was made, its relations established, photographed and sketched, its histologic structure studied, and the contents of the cyst examined.

¹ Since publishing his last article, Professor Miller has found two more of these bladders in the cat.

ANATOMICAL RELATIONS

This bladder was somewhat pear-shaped, its diameters being 2 and 2.5 cm., the capacity equaling that of the gall bladder approximately. It lay slightly to the left of the midline attached to the gall bladder and caudad of it (see fig. 1). Close inspection showed that these two reservoirs were very intimately associated, but were completely separated, the line of division being distinctly marked off by the color of the two. Furthermore, careful examination revealed no opening from one to the other. A duct, equal in size to the ductus communis choledochus, could be traced from the pancreatic bladder to the duodenum, which it entered by a peculiar arrangement to be described presently. This cystic duct entered its cyst at an oblique angle, the opening being 2 mm. wide and quite patent.

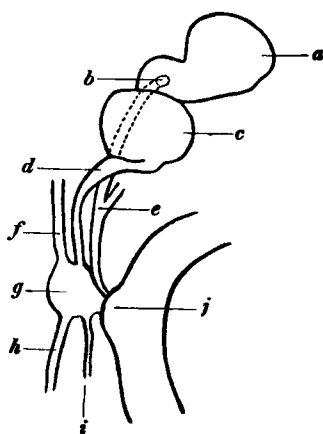


Fig. 1 Diagram to show the relations of the pancreatic bladder. Approximately one-half normal size; *a*, gall bladder; *b*, orifice of the cystic bile duct; *c*, pancreatic bladder; *d*, duct of pancreatic bladder; *e*, common bile duct; *f*, axial branch of the cauda pancreatis; *g*, cavity, or sinus, into which the cystic and pancreatic ducts empty; *h*, axial branch of the caput pancreatis; *i*, ductus accessorius; *j*, swelling of the ampulla of Vater, in the duodenum.

On tracing the tube towards the intestine, it was found to lie for the most part ventrad of the common bile duct. At the point where the ductus communis choledochus and ductus

pancreaticus ordinarily enter the duodenum there was found a unique variation, adjacent to the ampulla and embedded in pancreatic tissue. This variation consisted of an enlargement or sinus into which entered four ducts. An idea of the arrangement can best be gained from the diagram. One of the ducts was that from the pancreatic reservoir; two were the divisions of the ductus pancreaticus (Wirsung's), coming from the splenic and duodenal portions of the gland; and the fourth was either the ductus accessorius (Santorini's), or simply an extra duct draining a small portion of the pancreas near the ampulla of Vater. From this peculiar cavity, or common point of union of these various ducts, a single, very small channel led into the duodenum, through the ampulla, along with the common bile duct.

As far as the writer has been able to determine, this mode of termination of the cystic and pancreatic ducts is quite unique. In Mayer's case the cystic duct joined the trunk of the ductus pancreaticus, and Professor Gage found the same mode of termination of the cystic duct in his specimen, except that it divided near its termination, sending the larger branch to the gastro-splenic division of the duct of Wirsung, and the smaller branch to the common trunk of this duct. Miller, in his articles of 1904, 1905, and 1910, describes two types of union of the cystic and pancreatic ducts. In one of his cases the cystic duct terminated in the gastro-splenic division of the ductus pancreaticus, while in the other four cases it joined the duodenal division, the junction in all five cases being within a few millimeters of the main trunk of the ductus pancreaticus.

HISTOLOGICAL FINDINGS

The specimen and adjacent structures were fixed in 10 per cent formalin, hardened in alcohol, sectioned in paraffin and stained with haematoxylin and eosin. Some sections were also stained especially for muscle, elastic, and gland tissue. It was found that the microscopic structure was essentially like that of the gall bladder and its duct. There could be distinguished mucous, muscular and serous coats. The mucosa was consid-

erably less folded and had fewer glands than that of the gall bladder, and its epithelium was columnar and laid down upon a well defined basement membrane. The nature of the glands could not be determined. The plain fibers of the muscular coat were arranged in interlacing bundles, the direction of which was quite irregular.

A section was made through the partition separating the pancreatic and gall bladders, at a point (x in fig. 1), which revealed that they were covered by a common peritoneum.

A cross section of the duct showed that it was made up of the same coats as the bladder. Its muscular coat was well developed, the fibers being mainly circular and especially numerous in the muscularis mucosae. In the mucosa were a good many longitudinal muscle fibers. Tubular glands could occasionally be seen embedded deeply. They were not true mucous glands; further than this nothing can be said about them.

Contents of the bladder

Before the specimen was dissected it was opened, the contents withdrawn into sterile tubes and examined for digestive enzymes. Unfortunately, a towel wet with 10 per cent formalin had been laid over the exposed viscera before the nature of the sac was recognized. However, some evidence of enzymes was obtained. The fluid, about 2 cc. in quantity, having been proved to be sterile, a portion of it was put into a weak starch solution. In the course of a few hours the starch disappeared. As formalin does not interfere with the iodine test for starch, and as there were no bacteria, it seems fair to conclude that amylase was present. No evidence of proteolytic or other enzymes could be obtained, doubtless because of the formalin.

THE ORIGIN AND FUNCTION OF PANCREATIC BLADDERS

In his last paper Miller discusses briefly two hypotheses as to the origin of these structures. He points out that Heuer, in his work upon the pancreatic ducts of the cat, records an

observation that is suggestive. Heuer described an anomalous condition of the pancreas consisting of a band of pancreatic tissue extending along the ductus choledochus, the band in one case being very narrow and terminating in an expanded end near the gall bladder. As Miller states, it is conceivable that this outgrowth of pancreatic tissue could undergo degeneration in such a way as to become a duct with a distal enlargement forming a bladder. A more probable view, he thinks, would be: "that the ventral anlage in place of being double, may in these cases be bilobed, either from the beginning or as a result of fusion, one of the lobes having given rise to the caput of the pancreas, and the other to the bands of pancreatic tissue described by Heuer, or to the pancreatic bladders." According to this view then, these bladders would arise from true pancreatic tissue.

Another explanation suggested by F. T. Lewis is that they are cases of subdivided hepatic diverticulum, that is: "They are cases of double gall bladder, emptying into a subdivided cystic and common bile duct. The inferior subdivision (pancreatic bladder) has lost its connection with the liver, but has retained its connection with the ventral pancreas."² In his latest discussion of the embryology of the liver and pancreas (see references below) Professor Lewis has given the evidence upon which he bases his conclusion, which is further supported by an observation by Miller, who discovered a double gall bladder in a cat which was a full brother to one of the animals possessing a pancreatic bladder described by him in 1904. Both interpretations may be defended, but it is evident that a satisfactory settlement of the point at issue cannot be obtained until a thorough study has been made in the embryo of the cat.

The statement was made earlier in this paper that these bladders doubtless serve as reservoirs for pancreatic juice. While the author has evidence that enzymes were present in his own specimen, it may well be doubted that these cysts always contain true pancreatic juice. There is nothing in the

² Personal communication to the writer.

literature to show that a careful study has been made of this point, which, in as much as it deals with the possibility of an unusual function in connection with the pancreas, is quite as important as the mode of origin of the structure under discussion.

In the introduction, the writer supplements Professors Gage and Miller in calling attention to the rarity of these bladders. It is interesting to note that Professor Miller alone has seen seven, five of which he has described; and it is also very suggestive that three of his specimens were found in cats from the same farm. One of these cats had a full brother at a neighboring house, and this cat furnished the third pancreatic reservoir observed by him that year. There is strong evidence in these cases, therefore, that the cysts were inherited structures. The writer suggests that it would be interesting to attempt to obtain a race of cats possessing these bladders by breeding experiments with the near relatives of the one in which a pancreatic bladder is found. At any rate, it certainly would be worth while to make a practice in various laboratories of having the abdomens of cats, and other animals, opened whenever possible, in order to determine whether or not a pancreatic bladder be present. For physiological experiments, these cysts, if they were true reservoirs for pancreatic juice, would be most useful, as it would be very easy to convert them into permanent pancreatic fistulae, an operation of considerable difficulty under ordinary circumstances.

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