On the Sensory Terminations Formed along the Ductus Pancreaticus in Cat.

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The existence of PACINIan bodies in the pancreas of mammals, especially of cat has been reported on since the days of KRAUSE, KÖLLIKER and PETRINI and more recently, KUTSUZAWA, one of the present authors, has succeeded in demonstrating not only very well-developed PACINIan bodies in his sections of feline pancreas impregnated by SETO’s method, but also simple unbranched and branched terminations, as previously found by SETO and UTSUSHI in the pancreas of human embryos, in the parenchyma of his cat pancreas. He has reported on the existence of simple branched terminations in the ductus choledochus as well.

The authors of this paper, beside the preparations made by KUTSUZAWA, used a large series of histological preparations of cat pancreas, especially of its caput fixed in 10% formol solution for a long time, cut into 40μ frozen sections and stained with SETO’s silver impregnation method in our study and could ascertain the existence of sensory terminations in the wall of the ductus pancreaticus too. We will hereunder report on this as yet unreported and accordingly very interesting discovery.

The pancreas of cat, as that of man, is provided with two ducts, the ductus pancreatici major and minor, of which the former finally unites with the ductus choledochus but the latter does not come together with the choledochus but opens out into the duodenum. Surrounding these ducts, we found sensory terminations originating in thick medullated fibres, as are found along the duodenum and the choledochus. Interestingly enough, the number of such terminations was much larger around the minor than around the major duct. The sensory terminations are particularly numerous and well developed near the part where the minor duct opens out into the duodenum and grow rapidly fewer toward the pancreatic parenchyma, a finding similar to that obtained by KUTSUZAWA in his study on the ductus choledochus of cat, where also the development of sensory terminations was particularly good near the outer orifice of the choledochus. Sensory fibres and their terminations were not rare around the ductus...
pancreaticus major either, but they were much poorer than those near the orifice of the ductus minor in number as well as in the construction of the terminations.

The mucous membrane of the ductus pancreaticus minor of cat is lined by a one-rowed high cylindrical epithelium, then a thin layer of propria mucosae and a muscularis mucosae consisting of longitudinally running smooth muscle fibres on the outside. This is covered by an adventitia of connective tissue rich in blood vessels.

Mucous folds, always arranged in longitudinal rows, are formed on the surface of the mucous membrane. Especially, the folds are in good development near the opening of the duct into the duodenum. It is of interest that in the formation of these folds, only the epithelium and the propria take part, but not the muscularis mucosae. Crypts formed by the epithelium depressed far into the propria are also found in many places but no mucous glands as frequently found in the ductus choledochus.

It is also of deep interest that the muscularis is very ill developed or sometimes almost entirely absent in the major duct while it is quite well developed in the minor duct of the pancreas, particularly well in the part where the latter opens out into the duodenum. When the minor duct merges into the duodenal wall, this longitudinal muscle layer passes over into the lamina muscularis mucosae of the duodenum.

In both the major and the minor pancreatic ductus is found nerve plexus containing small ganglia formed in their adventitia (Fig. 1). This plexus comes into better development as the ducts approach the choledochus and the duodenum. This plexus is of vegetative nature and consequently, the nerve fibres of which they are composed are non-medullated fine vegetative fibres and the nerve cells therein are multipolar sympathetic cells like those found in the walls of the ductus choledochus and the duodenum. The nerve processes sent out by these cells are far poorer in development than those in the human counterpart, many apolar cells also being observed among them.

Some medullated sensory fibres are also contained in this plexus here and there, in rather large number in some places. The vegetative fibres in the pancreatic ducts, quite as in the duodenum and the choledochus of cat, finally pass over into STÖHR's terminal reticula (Fig. 3) which spread out widely in the mucous membrane.

The sensory fibres coming into the ductus pancreatici originate in the rami of the nn. splanchnici running into the caput pancreatis on its dorsal side. The density of the sensory fibres and their terminations distributed in the thickest part of the minor duct where it opens out into the duodenum is little inferior to the density of those found in the part of the ductus choledochus near its opening into the duodenum (KUTSUZAWA)
On the Sensory Terminations Formed along the Ductus Pancreaticus in Cat. 523

(Figs. 1, 2, 3 and 4).

The sensory fibres supplied to the pancreatic ducts, in particular, those in the minor duct, run through the muscularis mucosae into the propria mucosae to form their termination there. Their terminal formation is mostly of that of simple branched type, but complex branched terminations are not rare either, while a small number of the fibres end without branching.

The sensory fibres are either very thick or of medium size. The terminal fibres originating in the thick fibres usually run very characteristic winding courses while showing very perceptible change in size, while those of the medium-sized fibres show little change in size during their courses often lacking in perceptible winding. What is common to the terminations of these two types of sensory fibres is that their terminal fibres usually end in sharp points and that they often run up to the very base of the epithelium or the epithelial crypts but never penetrate into these epithelial cells. In the following, we wish to refer the readers to the illustrations in going on with our descriptions.

Fig. 1. A bifurcated sensory termination formed in the propria of the minor pancreatic duct of a cat. g a small ganglion in the adventitia, f vegetative fibres in the propria, m muscle layer. Details in the text. SETO’s impregnation. ×320, reduced to 1/2.
Fig. 1 shows a bifurcated termination formed by a very thick sensory fibre, found in the mucous membrane of the minor pancreatic duct of cat. This fibre runs through the muscularis mucosae accompanying some fine vegetative fibres into the propria, extends longitudinally therein and finally reaches its terminal territory upon bifurcating into two terminal branches, the one thick but the other somewhat thinner, which both run long characteristically winding courses showing perceptible change in size and end in sharp points. In Fig. 2, we find 3 simple branched terminations formed in the propria of the minor duct. Of these, those located in the upper and the right-hand parts of the picture originate in comparatively thin sensory fibres and show no marked winding or change in size in the courses of their terminal branches, but that seen in the lower part of the illustration is a branched termination of a thick sensory fibre, of which the 3 terminal fibres are all rather thin and show little change in size but very notable windings in their courses.

In Fig. 3 are illustrated 3 simple branched terminations originating in medium-sized fibres found in the vicinity of epithelial crypts in the minor pancreatic duct of cat. Here, the terminal fibres show no marked change in size or winding in their courses of varied length, before ending.

Fig. 2. 3 simple branched sensory terminations (a, b, c) formed in the propria of the minor pancreatic duct of a cat. m muscularis mucosae, e epithelial crypt. Details in the text. Same staining. ×320, reduced to 1/2.
On the Sensory Terminations Formed along the Ductus Pancreaticus in Cat. 525

in the propria and often just beneath the base of the crypts in sharp points but never in the epithelium itself. The thick sensory fibre shown in Fig. 4, upon entering the propria through the muscularis mucosae of the minor duct, undergoes a rather complex ramification near the epithelium and the epithelial crypts and then forms a branched termination, of which the terminal fibres run comparatively short winding courses while changing rather markedly in size to end sharply, never penetrating into the epithelial cells here either.

In summary of the above, we may state that a relatively large quantity of sensory fibres and their terminations are found in the pancreatic ducts of cat, in particular, in the part of the minor duct opening out into the duodenum, quite as in the similar part of the ductus choledochus as reported by KUTSUZAWA. The terminations mostly consist in those of the simple branched type and have terminal fibres usually showing perceptible change in size during their characteristic winding courses.
Fig. 4. A complex branched sensory termination originated in a thick medullated fibre formed in the propria of the minor pancreatic duct of a cat. m muscle layer, e epithelial crypt. Details in the text. Same staining. ×320, reduced to 1/2.

References.