Bulletin UASVM, Veterinary Medicine 67(1)/2010
ISSN 1843-5270; Electronic ISSN 1843-5378

Morphological Studies of the Pancreas in the White Wistar Rat

Aurel DAMIAN, Viorel MICLĂUŞ, Ionel PAPUC

University of Agricultural Sciences and Veterinary Medicine, Faculty of Veterinary Medicine, 3-5 Mănăştur Street, 400372, Cluj, Romania, e-mail: catedra1mv@yahoo.com

Abstract. Of all the subsidiary glands of the digestive apparatus, the pancreas represents an important issue in the animal economy. This fact made us to investigate it on a macroscopic scale. We had in view the location (topographical situation) and the morphologic aspect. Then, we continued with microscopic investigations. We observed in parallel 7 white rats and registered the anatomohistological data about the pancreas of this species. The topography of the pancreas in rat does not present great differences compared to what is already known in other species, and especially in the laboratory animals. We did not noticed major morphological differences. The excretory apparatus of the pancreas is complex, being represented by a canalicular system out of which the two pancreatic ducts will form: Wirsung - the main one and Santorini - the accessory pancreatic duct. The endocrine pancreas of the rat presents like in other species the two types of cells B and A.

Keywords: exocrine and endocrine pancreas, laboratory animals, histology and morphology

MATERIALS AND METHODS

The study was conducted on 7 white Wistar rats, 3 females and 4 males, with a body weight around 160 g, in a good body condition and without any abnormal clinical findings. The animals were anesthetized and then euthanized by sectioning the jugular vein. In order to reveal the abdominal organs and the pancreas, the white line was incised from the xiphoidian apendix to the pubic arch. Other two lateral incisions parallel to the last pair of ribs till the lumbar vertebrae were performed (Fig.1).

Fig.1.Topography of the abdominal organs in rat

After the morphological examination of the pancreas, samples were collected for the histological exam. The pieces were fixed in 10% formaldehide, respectively in Bouin solution. After the paraffin embedding, 6 μm sections were obtained. Tissue samples were stained using trichrome Masson-Goldner staining method.

Following the anatomohistological examination, a pertinent study regarding the morphological aspect of the pancreas in rat compared to other species can be realized.

RESULTS AND DISCUSSIONS

The topography of the pancreas in rat does not present great differences compared to what is already known in other species, and especially in the laboratory animals. We did not noticed major morphological differences.

The pancreas is situated in a well precise topographic area - retrodiaphragmatic, in the flexure of the duodenum, in the cranial part of the sublumbar region (Fig.2). Its dorsal surface is in contact to the dorsal wall of the abdominal cavity and lies in closer proximity to the aorta artery, caudal vena cava, celiac artery trunk and right kidney. Ventrally lies nearby the intestinal mass, particularly to the duodenum, jejunum and ileonum. The anterior extremity – the pancreatic head, is in the vicinity of the right lobe of the liver and in close contact to the first duodenal flexure. The left extremity is usually narrow and corresponds to the tail of the pancreas (Fig.3).

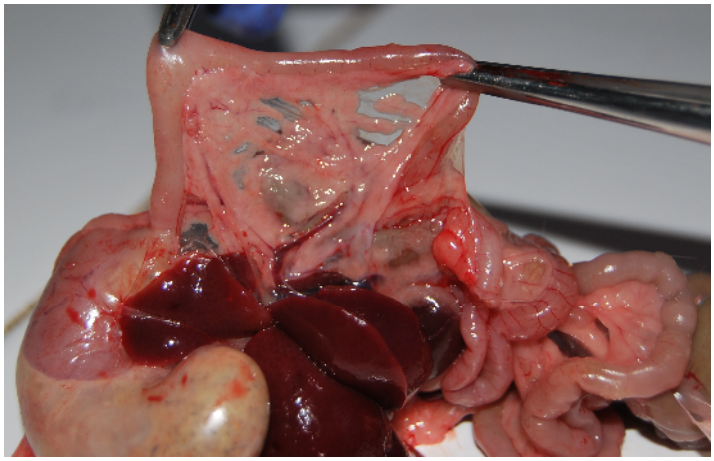

Fig.2.Morphological aspect of the pancreas and duodenum in rat

Fig.3. Head, body and tail of the pancreas

The excretory apparatus of the pancreas is complex, being represented by a canalicular system out of which the two pancreatic ducts will form: Wirsung - the main one and Santorini - the accessory pancreatic duct. In this specie the two ducts are opening separately in the duodenum, one in front of the other, at 3 to 5 cm distance from the pyloric orifice.

The structure of the pancreas in rats reveals the presence of a connective stroma formed by thin septa that divide the pancreatic parenchima in lobes and lobules. The parenchima is formed by pancreatic acini that have an exocrine function (Fig.4). Embedded within this exocrine tissue, another excretory canalicular system and clusters of endocrine cells - the *Islets of Langerhans* are noticed (Fig.5).

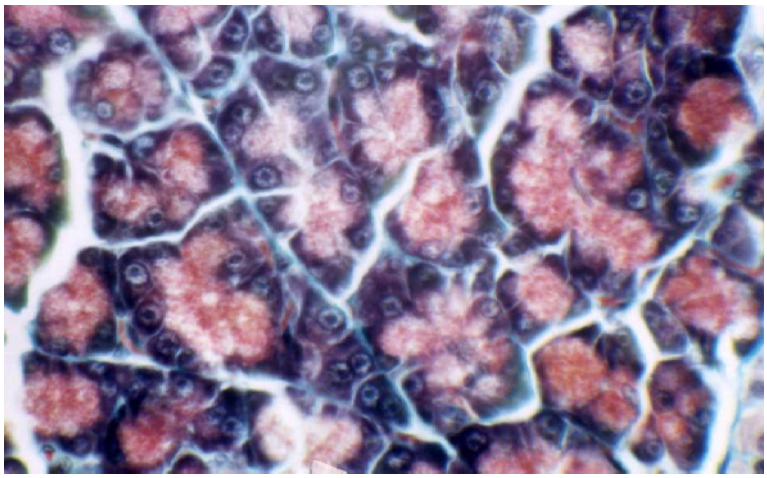

Fig.4.Pancreatic acini during their secretory activity
(Trichrome Masson - Goldner Stain, 500x)

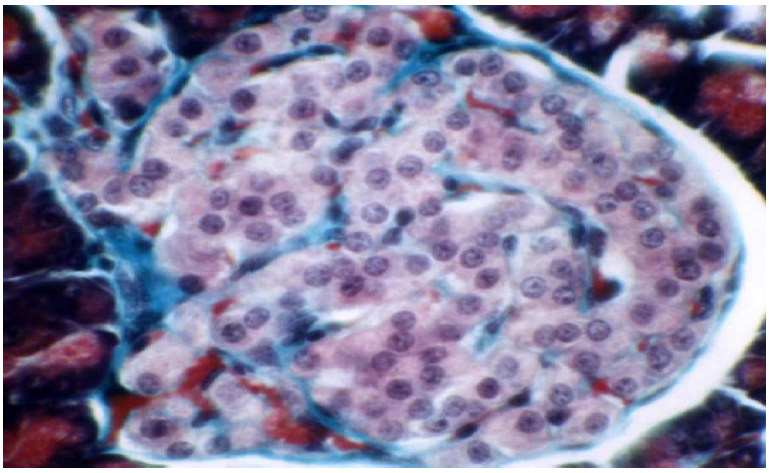

Fig.5.Islet of Langerhans
(Trichrome Masson - Goldner Stain, 500x)

The pancreatic acini are mainly serous and have an irregular shape. Like in other species the cells have the shape of a truncated cone, with a large and round nucleus situated in the deep part of the cell. The nucleoli are well developed and can be easily visualized. The

cytoplasm has a filamentous striated aspect, due to the fact that the basal cells are basophiles on the half of their surface.

The flattened nucleii of the myoepithelial cells are situated at the base of pancreatic cells. Boll passage is very similar to the ones from the parotid gland. The interlobular ducts present an epithelium with high cells and striated plateau at the apical pole (Fig.6).

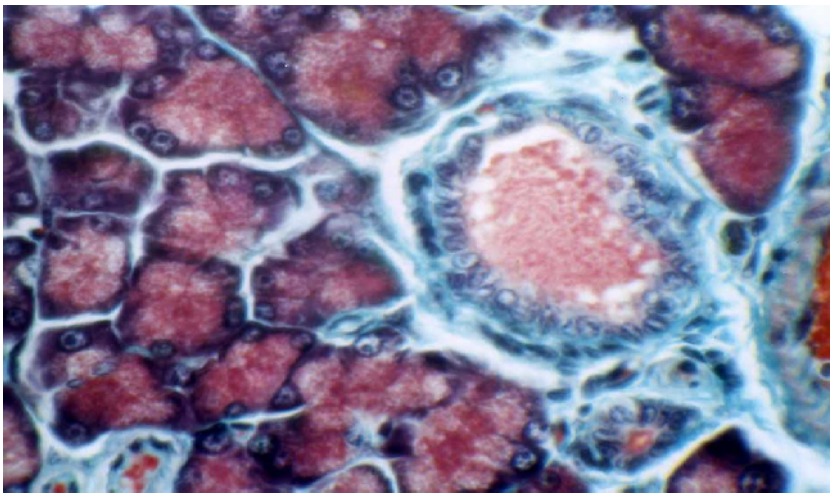

Fig.6.Pancreatic acini and an excretory interlobular duct
(Trichrome Masson - Goldner Stain, 500x)

It can be noticed that the histological findings from the samples prepared in parallel with the two fixation solutions did reveal similar aspect of the structure of the pancreatic acini. The differences were technical and qualitative. The histological structure of the pancreatic acini in rat is not significantly different from other animals.

It is easy to notice the qualitative differences between the two methods. With formaldehide fixation solution, the nucleii were well emphasized compared to the citoplasma, the latter one having a homogeneous aspect and the secretory granules could not be highlighted.

In the case of Bouin fixation solution the results are superior to the former one, all the components of the pancreatic acini being very well emphasized. The nucleii have a blue appearance, round shape, a clear outline and the chromatin network and the nucleolus well highlighted. The secretory granules from the cytoplasm of the serous cells from the pancreatic acini are well individualized and nicely stained.

All the results highlight the fact that the Bouin solution presents more advantages for the histological examination of the exocrine pancreas. If the investigation of the endocrine pancrease is desired, the Bouin solution is not recommended because even if it preserves very well the cells from the islets, it produces hematolysis and the blood component cannot be appreciated.

The endocrine pancreas of the rat presents like in other species the two types of cells B and A. The B cells have a basophile cytoplasm and the A cells have an acidophil one.

The quantitative measurements of the endocrine pancreas revealed values that are in the normal parameters compared to the ones from other species. The islets are present in a percentage of 3.0% in the head of the organ, 2.5% in the body and only 0.8% in the tail. The B cells predominate with a percentage of approximately 90%, the A ones being around 10%. This distribution is similar to the one from other species.

CONCLUSIONS

- The pancreas of the white Wistar rat registers in the common rule of the other species studied in our departments;
- The topography of the organ is similar from many points of view to the one from other species of mammals, specially the laboratory ones, without presenting major differences from the common rule;
- The excretory apparatus of the pancreas is well represented by the two pancreatic ducts: Wirsung, the main one and Santorini, the accessory one, and respects the common rule regarding the structure and distribution;
- The pancreatic parenchima is divided by thin connective septa in lobes and lobules, formed by pancreatic acini with exocrine role and areas with endocrine role - the exocrine parenchima being more predominant;
- The endocrine pancreas has a different quantitative disposition depending on the three portions of the organ - head, body and tail. In this specie the B cells are more predominant compared to the A ones;
- The formaldehide fixation solution is indicated when the histological investigation of the endocrine pancreas is desired, but in the cases when the endocrine pancreas is histological examined, the Bouin fixation solution is recommended.

REFERENCES

1. Atanasiu, N., S. Peredelnic, 1970, Creşterea animalelor de blană, Ed. Ceres, Bucureşti.
2. Barone, R., 1994, Anatomie compareé des mammiferes domestiques, vol. I, II, Imprimerie des Beaux Arts J. Tixier and Fils S.A., Lyon.
3. Coman, T., N. Cornilă, 1999, Embriologie veterinară, Editura Fundaţiei "România de mâine", Bucureşti.
4. Coţofan, V., Valentina Hritcu, R. Palicica, G. Predoi, A. Damian, Carmen Ganţă, V.Enciu, 2007, Anatomia animalelor domestice, vol.II Ed.Orizonturi Universitare, Timişoara.
5. Damian, A., 2001, Anatomia comparată - Sistemul cardiovascular, Ed. Academic Pres, Cluj-Napoca.
6. Krinke, G.J., 2000, The Laboratory Rat (Handbook of Experimental Animals), Ed. Academic Press.
7. Miclăuş, V., C. Paşca, C. Lisovschi, 1999, Histologie şi tehnică microscopică, Ed. Risoprint, Cluj-Napoca.
8. Miclăuş, V., C. Lisovschi-Cheleşanu, 2000, Histologie animală, Ed. Risoprint, Cluj-Napoca.
9. Miclăuş, V., 2001, Histologie specială. Ed. Risoprint , Cluj-Napoca.
10. Popovici, I., A. Damian, N. Popovici, Ioana Chirilean, 2003, Tratat de anatomie comparată - Splanhnologie, Editura AcademicPres, Cluj-Napoca.
11. Predoi, G., 1999, Anatomia comparată şi topografică a animalelor domestice. Ed. Casa Cărţii de Ştiinţă, Cluj-Napoca.
12. Sharp, P.E., L.A. Regina, C. Marie, 1998, The Laboratory Rat, Ed.CRC Press.
13. Tudor, Despina, Gh. Constantinescu, 2002, Nomina Anatomica Veterinaria, Editura Vergiliu, Bucureşti.
14. *** Nomina Anatomica Veterinaria, 2003, together with Nomina Histologica (Revised second edition) and Nomina Embryologica Veterinaria. Zurich and Ithaca, New York.