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Histology of endocrine pancreas of large white Yorkshire pigs (*Sus Scrofa*)

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Abstract

The present study was carried out to reveal the histomorphological features of endocrine pancreas in large white Yorkshire pigs. The Pancreas of large white Yorkshire pigs consisted of splenic, duodenal and connecting lobes. The pancreas was covered by connective tissue capsule and from which interlobular and intersublobular septa divided the gland into lobules and sublobules. Each sublobule consisted of exocrine pancreatic acini and endocrine islets of Langerhans. The islets of Langerhans appeared as lightly stained clusters among darkly stained pancreatic acini. Variable sized and shaped islets of Langerhans were found in all the three pancreatic lobes. Islets of Langerhans consisted of alpha, beta and delta cells. Each pancreatic islet was found surrounded by fine reticular fibres. In chrome alum haematoxylin phloxine staining, the alpha cells appeared red, beta cells blue and delta cells as pink. The number of islets per lobule was higher in splenic lobe of pancreas of young pigs than adult.

Keywords: Alpha cell, Beta cell, Delta cell, Endocrine pancreas

Introduction

The islets of Langerhans are the endocrine portion of pancreas which make and secrete insulin, glucagon, somatostatin and pancreatic polypeptide into the blood and it forms 1-2% of the pancreatic mass [1]. Paul Langerhans described the structure of islet in his thesis entitled "Contributions to the microscopic anatomy of the pancreas", hence the islets of pancreas were named as islets of Langerhans [2]. The pancreas has been used as an important organ for endocrine research in correlation with pancreatic disorders of diabetes [3]. Pigs have been proven to be an important model in translational research particularly in medical device development, xenotransplantation and therapeutics due to the similar anatomy and physiology of human and pig organs [4]. Pigs could provide an abundant and ready supply of pancreatic islet xenografts for type I diabetes [5]. Hence the present study was undertaken to know about the histology of endocrine pancreas in large white Yorkshire Pigs.

Materials and Methods

The pancreatic tissue samples for the present study were collected from different age groups of large white Yorkshire pigs of either sex. The study was carried out in the Department of Veterinary Anatomy, Veterinary College and Research Institute, Namakkal. The tissues from splenic, duodenal and connecting lobes of pancreas were collected and fixed in various standard fixatives viz., 10% neutral buffered formalin, Bouin's fluid and formal calcium. Fixed tissues were processed through ascending grades of alcohol, cleared in xylene and embedded in paraffin wax at 58-60°C as per the method described by Luna [6]. Sections of 3-5 µm thickness were made by using Leica Rotary microtome. Then the sections were stained with routine haematoxylin and Eosin staining technique and some special staining techniques [7]. Histological features of the pancreas with age related changes were studied and photographed with the help of DM1000 Leica Trinocular Microscope with Image Analyzer.

Results and Discussion**Endocrine Pancreas**

The endocrine pancreas was formed by lightly stained clusters of cells (Fig. 1) and were noticed among darkly stained pancreatic acini as in Madras red sheep [8]. The delineation of islets of Langerhans from the surrounding acini was very distinct as mentioned in pig by Jay *et al.* [9] who also stated that the islets were clearly defined by complete perimeter of collagen.

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In accordance with study of Singh and Gupta ^[10] in buffalo, the islet encapsulation was also sparse and only a few reticular fibres were seen around some islets. In each lobule, many variable sized islets of Langerhans were noticed and they were of small, medium and large sized as observed by Tsuchitani *et al.* ^[11] in rat. The shape of islets of Langerhans were also differed and seen as round, oval and irregular in all the age groups of pigs studied. The islets were richly supplied with blood capillaries as in African giant pouched rat ^[12].

Among the three lobes of pancreas, numerous small and round islets were observed in all pancreatic lobes and relatively more number of large sized islets was seen in the connecting lobe of pancreas. Within the lobules, more islets were distributed in the periphery than central region. In some of the lobules, the islets were scattered throughout the lobule. But in dog ^[11], it was reported that medium and small sized islets were found in the body and left lobe and only small islets in right lobe of pancreas. The number of islets per lobule was higher in splenic lobe of pancreas of young pigs than adult.

As mentioned in horse, cattle and camel, the islets of Langerhans consisted of alpha, beta and delta cells (Fig. 2). These cells were varied in number and showed different distribution patterns within the islet as in monkeys ^[11]. By chrome alum haematoxylin phloxine staining technique, the islets which had more number of alpha cells were distinguished as alpha islets (Fig. 3) and the islets with more beta cells were observed as beta islets (Fig. 4). In alpha islets, alpha cells were noticed in the periphery and centre; few beta cells were seen between the alpha cells. In beta islets, beta cells were noticed throughout the islet and alpha cells were found sparsely among beta cells. In some of the islets even distribution of both alpha and beta cells were seen. In contrary, Tsuchitani *et al.* ^[11] reported that in monkey, the alpha cells were distributed in all parts and beta cells were accumulated in periphery of alpha islets and in beta islets, the beta cells were distributed in all parts and alpha cells were found only in the centre.

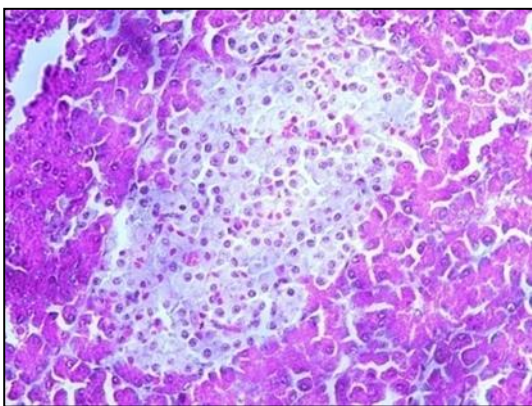


Fig 1: Photomicrograph showing the islets of Langerhans among exocrine pancreatic acini Chrome alum haematoxylin phloxine staining X 400

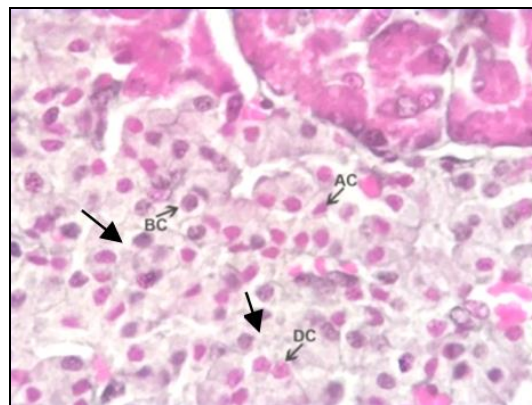


Fig 2: Photomicrograph showing the cells of endocrine pancreas AC-Alpha cell, BC-Beta cell DC-Delta cell Chrome alum haematoxylin phloxine staining X 1000

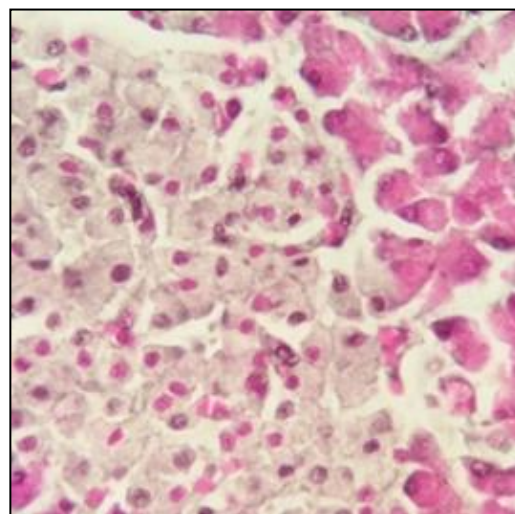


Fig 3: Photomicrograph showing the alpha islet. Chrome alum haematoxylin phloxine staining X 1000

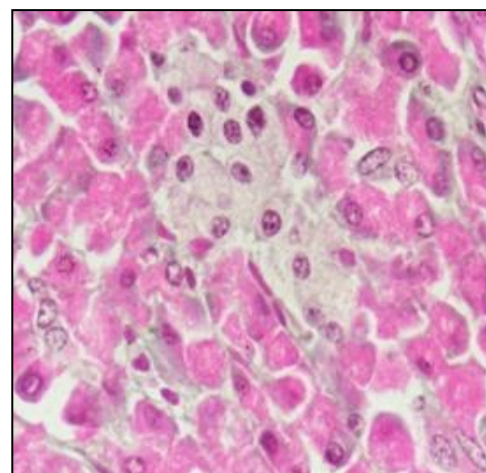


Fig 4: Photomicrograph showing the beta islet. Chrome alum haematoxylin phloxine staining X 1000

Alpha cells

The alpha cells were oval to polygonal in shape and had eccentrically placed round to oval nuclei with prominent nucleoli as reported in Madras red sheep [8].

The granules in the cytoplasm of alpha cells appeared red in chrome alum haematoxylin phloxine staining and black in silver staining technique as mentioned by Singh and Gupta [10] in buffalo.

Beta cells

The beta cells were numerous in most of the islets of Langerhans and were round to oval with spherical nucleus and distinct nucleoli and appeared blue in chrome alum haematoxylin phloxine staining as observed as stated by Prakash *et al.* [8] in Madras red sheep. Whereas, Dehkordi and Moradi [13] reported that the beta cells were polygonal or elliptical shaped with a spherical nucleus.

Delta cells

The presence of delta cells were very less and appeared as small round cells in the islets. Similarly, Dhoolapa *et al.* [14] also reported less occurrence of delta cells when compared to other endocrine cells and delta cells as small polygonal shaped cells in Indian Donkey.

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