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Histological studies of the Uriniferous tubule in the kidney of large white Yorkshire pig (*Sus scrofa*)

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Abstract

The study was conducted on apparently healthy 6 large white Yorkshire pig of either sex between the ages of 5-8 months. In histological studies of Uriniferous tubule, the renal corpuscle was spheroidal body. The proximal convoluted tubule was lined by simple truncated pyramidal cells with brush border. The thin segment of henle's loop was lined by flattened epithelial cells and the thick segment of henle's loop was lined by cuboidal epithelium. The distal convoluted tubule was lined by cuboidal epithelium, had visible clear lumen and the cells of these tubules lacked a well developed brush border of microvilli. The papillary duct lined with simple columnar epithelium which become transitional before opening into the papilla.

Keywords: Pig, kidney, histological, Uriniferous tubule, epithelium

1. Introduction

Large White Yorkshire originated in Yorkshire County, England. Yorkshire also called as a Large White breed of pig produced in the 18th century by crossing the large indigenous white pig of Northern England with the smaller, fatter white Chinese pig (Wikipedia, 2011) [16]. A Pig is any of the animals in the genus *Sus*, within the Suidae family of even-toed ungulates. The adult pig has total 44 teeth. In mammals the kidneys are the chief excretory organs of the body. They have a major role in the maintenance of fluid and electrolyte balance, control of the blood pressure and maintenance of acid-base balance. The kidneys also produce and release a humoral agent (erythropoietin) into the blood stream which affects the blood formation. The structural and functional unit of kidney is uriniferous tubule that controls water and soluble substances by filtering and reabsorption in the blood and excreting the rest as urine. The results of this study will be useful to clinicians and para-clinicians for diagnosis and treatment of various ailments of this gland and will also help the scientists involved in research on urinary system of pig.

2. Materials and Methods

The kidneys from the freshly slaughtered animals were procured from a local slaughter house during summer for the histological examination. Small pieces of tissue (2 cubic mm size) was collected from 12 kidneys (6 right and 6 left). The tissues were preserved in 10% formal saline. Fixed tissues were later washed in running tap water for 6-10 hours followed by dehydration in ascending grade of alcohol, clearing, embedding in paraffin wax of melting point of 58-60 °C, preparation of blocks, section cutting (5-6 µm thick), mounting of section on albuminized slides, drying of sections and finally stained with the routine histological stains to demonstrate different components of the kidney.

3. Results and Discussion

The uriniferous tubule composed of both nephron and collecting tubules. The parts of nephron included renal corpuscle, proximal convoluted tubule, thin segment of Henle's loop, thick segment of henle's loop and distal convoluted tubule. The nephron and collecting tubules were entirely enveloped by basement membrane which was thickest in the parietal layer of the Bowman's capsule and in the thin limb of loop of henle, in present study. Similar observations were recorded by Dellmann and Brown (1993) [3] in domestic animals and Beniwal (1995) [1] in camel.

In present investigation, the renal corpuscle was spheroidal body. Similar findings were recorded by Dellmann and Brown (1993) [3] in horse, pig, sheep and goat. In the present study, the juxtamedullary renal corpuscle was larger than the cortical renal corpuscle.

This was in agreement with the findings of Sarmad-Rehan and Qureshi (2006) [8] in one-humped camel. Whereas, Yadava and Calhoun (1958) [17], Ommer and Mariappa (1970) [7] and Tiwari and Swarup (1977) [15] found that cortical renal corpuscles were larger than the juxtamedullary renal corpuscles in Indian buffalo. Similar observations were found by Hill and Reynolds (1989) [5] in West Indian manatee (*Trichechus manatees*).

Both the parietal and visceral layers of the Bowman's capsule had a flattened squamous epithelium enclosing considerable capsular space (Fig. 1), which was in consonance with the findings of Dellmann and Brown (1993) [3] in domestic animals and Singh (2013) [12] in Marwari sheep. Sreeranjini *et al.* (2008) [13] in Japanese quail stated that the renal corpuscles were of two types- smaller and larger, the parietal layer of Bowman's capsule in both types of renal corpuscles was lined by squamous epithelial cells with fusiform nucleus and visceral layer showed cuboidal podocytes projected into the capsular space.

The proximal convoluted tubule was lined by simple truncated pyramidal cells with brush border (Fig. 1), which was similar to the finding of Dellmann and Brown (1993) [3] in domestic animals, Shang-Jian *et al.* (2008) [9] in Panther, Gaykee *et al.* (2008) [4] in Sambhar, Charmi *et al.* (2010) [2] in Huso huso and Acipenser persicus and Singh (2013) [12] in Marwari sheep. Dellmann and Brown (1993) [3] in cat, numerous lipid droplets were found in the cells of proximal convoluted tubules but in present study lipid droplets were not found.

The thin segment of henle's loop was lined by flattened epithelial cells (Fig. 2), which was similar to the report of Dellmann and Brown (1993) [3] in domestic animals and Singh (2013) [12] in Marwari sheep. In the present investigation, the thick segment of henle's loop was lined by cuboidal epithelium, which was similar to the finding of Dellmann and Brown (1993) [3] in domestic animals and Sreeranjini *et al.* (2010) [14] in Japanese quail.

The distal convoluted tubule was lined by cuboidal epithelium, had visible clear lumen and the cells of these tubules lacked a well developed brush border of microvilli (Fig. 1). In majority of cells, the nucleus was located in the apical part of the cell, but in some cells the spherical, basally placed nuclei, which was similar to the finding of Dellmann and Brown (1993) [3] in domestic animals, Gaykee *et al.* (2008) [4] in Sambhar and Charmi *et al.* (2010) [2] in Huso huso and Acipenser persicus.

The lumen of arched collecting tubule was more regular and wider than that of the distal tubule. It was lined by a simple cuboidal epithelium. Present findings were in agreement with the findings of Dellmann and Brown (1993) [3] in domestic animals and Yadava and Calhoun (1958) [17] in domestic animals.

The straight collecting tubule was lined by simple cuboidal epithelium, the epithelium became wider and taller towards the papillary duct. Similar findings by Charmi *et al.* (2010) [2] in Huso huso and Acipenser persicus. In present study, straight collecting ducts were lined by simple cuboidal epithelium and nucleus contained a deeply stained nucleolus. This was in disagreement with the findings of Sreeranjini *et al.* (2010) [14] in Japanese quail stated that collecting ducts were lined by columnar cells of increasing height with distinct cell boundaries and contained a basal spherical nucleus with well developed nucleolus and light stained cytoplasm.

The papillary duct was lined by simple columnar epithelium (Fig. 3). Transitional epithelium was present at the opening of the ducts (Fig. 3). A similar observation was reported by Langham *et al.* (1942) [6] in the bovine kidney and Singh (1994) [11] in Marwari goat. On the other hand, Beniwal (1995) [1] observed that the papillary duct of the camel was lined by simple columnar as well as stratified columnar epithelium.

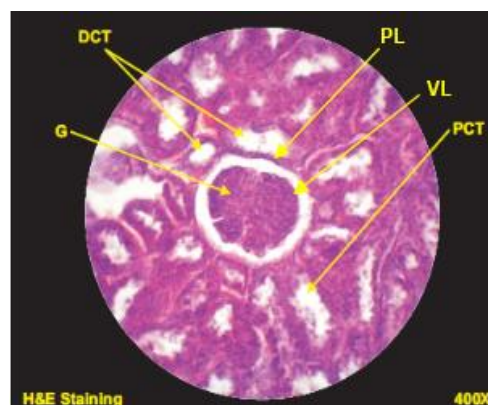


Fig 1: Section of kidney through cortex showing (G) Glomerulus, (PL) Parietal layer of Bowman's capsule, (VL) Visceral layer of Bowman's capsule, (PCT) Proximal convoluted tubule and (DCT) Distal convoluted tubule

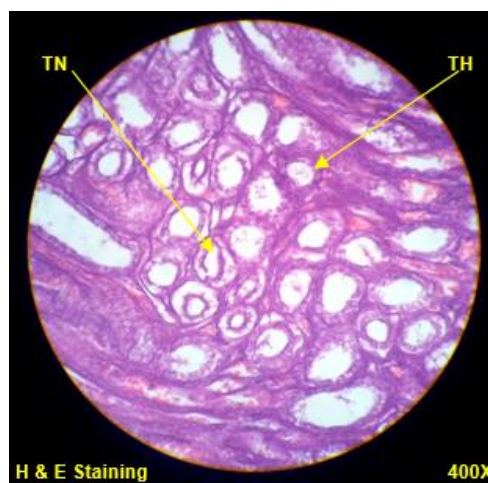


Fig 2: Section of kidney through medulla showing (TN) Thin segment and (TH) Thick segment of henle's loop

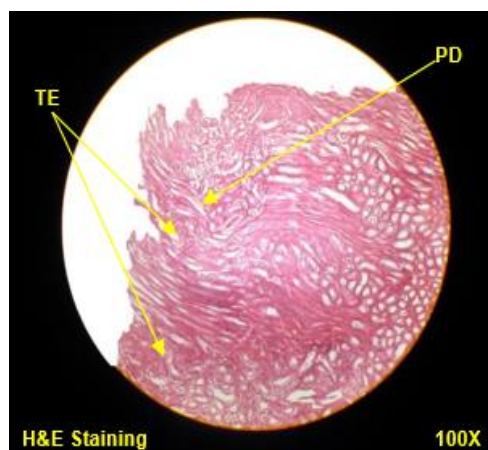


Fig 3: Section of kidney at the tip of the papilla showing (PD) Papillary Ducts and (TE) Transitional Epithelium

4. Conclusions

The present study concluded that renal corpuscle was spheroidal body, proximal convoluted tubule was lined by simple truncated pyramidal cells with brush border and the distal convoluted tubule was lined by cuboidal epithelium.

5. Acknowledgements

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