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Histological study of renal corpuscles and juxta glomerular apparatus in Japanese quail (*Coturnix coturnix japonica*)*

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ABSTRACT

The study was conducted on kidneys of 25 adult Japanese quails. Fresh specimens fixed in 10% neutral buffered formalin, Bouin's and Zenker's solutions were processed by routine paraffin embedding technique and sections were stained by Mayer's haemalum-eosin- phloxine and Crossman's modification of Mallory's triple stain methods. Renal corpuscles were of 2 types—smaller and larger. Smaller renal corpuscles were in large numbers and were distributed towards the periphery of renal cortex. Larger renal corpuscles were seen closer to renal medulla and were only few in numbers. The parietal layer of Bowman's capsule in both types of renal corpuscles was lined by squamous epithelial cells with fusiform nucleus. Visceral layer showed cuboidal podocytes projecting into the capsular space. A juxta glomerular apparatus consisting of macula densa, afferent and efferent arterioles, extra glomerular mesangial cells or lacis cells or goormaghtigh cells and juxta glomerular cells was also observed in the present study.

Key words: Juxta glomerular apparatus, Renal corpuscles, Japanese quail

Kidneys, one among the important homeostatic mechanisms of the body, produce some hormones concerned with systemic and renal dynamics and act as sites for RBC production, Ca, P and bone metabolism (Reece 1996).A bird with no kidney function is being reported to die within 36 h (Dhawale and Phatak 1998). Several studies have been reported on the urinary system of chicken, but detailed studies about the urinary organs of Japanese quail have been scantly documented. Hence the present study was undertaken.

MATERIALS AND METHODS

The study was conducted on kidneys of 25 adult Japanese quails. Fresh specimens were preserved in 10% neutral buffered formalin, Bouin's solution and Zenker's solution. Fixed tissues were processed by routine paraffin embedding technique. Serial sections of 5–6 µm thickness were cut and stained following Mayer's Haemalum-Eosin Phloxine method (Singh and Sulochana 1996) and Crossman's modification of Mallory's Triple stain method (Singh and Sulochana 1996).

RESULTS AND DISCUSSION

In the present study, nephrons with 2 types of renal corpuscles were observed—smaller renal corpuscles of reptilian type nephrons seen towards the periphery of renal cortex and larger renal corpuscles of mammalian type nephrons seen near medulla. The small renal corpuscles were in majority and were with an average capsular diameter of 34.2µm.The large juxta medullary nephrons were only few and were with an average diameter of 59.2µm (Fig.1). Casotti and Richardson (1993) observed 30µm capsular diameter for renal corpuscles of small cortical nephrons and 40 µm capsular diameter for renal corpuscles of large juxta medullary nephrons in honey eater kidneys.

Both types of renal corpuscles were having Bowman's capsule with parietal and visceral layers (Fig.2).The parietal layer showed a basement membrane lined by squamous cells with fusiform nuclei. This finding was in accordance with the observations of Nickel *et al.* (1977), Hodges (1974) and Siller (1971) in chicken and Fitzgerald (1969) in coturnix quail. The visceral layer of Bowman's capsule showed large cuboidal cells, the podocytes with vesicular nucleus and well developed nucleolus. This observation was similar to that of

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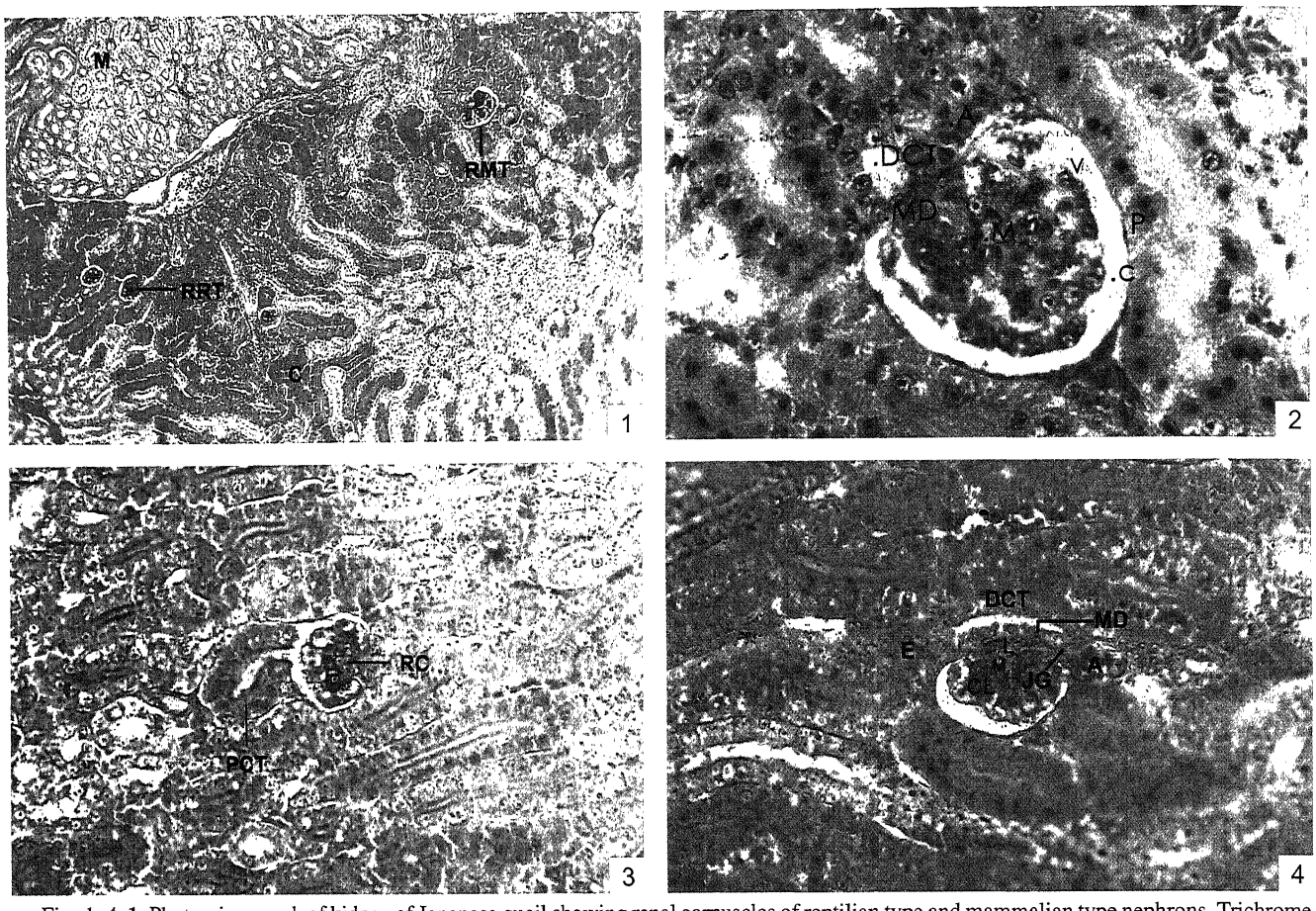

Figs 1–4. **1.** Photomicrograph of kidney of Japanese quail showing renal corpuscles of reptilian type and mammalian type nephrons. Trichrome ×100. RRT- Renal corpuscle of reptilian type nephron, RMT- Renal corpuscle of mammalian type nephron. **2.** Photomicrograph of a renal corpuscle H&E.×1000.P-parietal layer, V-visceral layer, C-capsular space, M-mesangial cells, MD-macula densa, DCT-distal convoluted tubule **3.** Photomicrograph of kidney of Japanese quail showing the urinary pole of a renal corpuscle.Trichrome.×400.RC-renal corpuscle, PCT-proximal convoluted tubule. **4.** Photomicrograph of kidney of Japanese quail showing juxta glomerular apparatus.Trichrome.×400. JG-juxtaglomerular cell, MD-macula densa, DCT-distal convoluted tubule L-lacis cell, M-mesangial cells, CL-capillary loop, A-afferent arteriole, E-efferent arteriole.

Siller (1971) and Hodges (1974) who reported the presence of cuboidal cells with large oval or round nucleus in the visceral layer of Bowman's capsule in avian kidney. Contrary to this, Nickel *et al.* (1977) mentioned the visceral layer of cells in avian Bowman's capsule as epicytes.

The glomeruli contained capillary loops lined by endothelial cells and a cluster of cells called mesangial cells with large vesicular nuclei and well developed nucleolus (Fig.2).These support glomerular capillary loops and maintain their shape. These can control the blood flow through glomerular capillary network and can take up large quantities of foreign material (Latta 1992). Siller (1971) and Schwarz and Radke (1981) also reported the presence of mesangial cells in the renal corpuscles of chicken. Casotti and Richardson (1993) observed the same in honey eater kidneys. Extra glomerular mesangial cells or lacis cells or goormagtigh cells were also observed in the present study at the angle formed by afferent and efferent arterioles and glomerulus. Similar observations were made by Christensen *et al.* (1982) in kidney of domestic fowl and Elqer *et al* (1998) in rat kidney. They develop occluding forces resulting in a pressure drop between macula densa and glomerular stalk (Elqer *et al.* 1998). In the present study, glomerular capillary loops and mesangial cells were comparatively more in renal corpuscles of juxta medullary nephrons. Parietal layer of Bowman's capsule, mesangial cells and basement membrane of capillary loops showed a PAS-positive reaction. Siller (1971) and Hodges (1974) reported the presence of PAS-positive basement membrane for visceral layer of Bowman's capsule.

The vascular pole of renal corpuscles was having an afferent and efferent arteriole and the urinary pole continued as proximal convoluted tubule (Fig.3). At the vascular pole of both small and large nephrons, juxta glomerular apparatus was observed. It included a distinct macula densa in the wall of distal convoluted tubule (DCT) facing the vascular pole

of renal corpuscle (Fig.2). Morild *et al.* (1985) in kidney of Japanese quail and Casotti and Richardson (1993) in kidney of honey eater birds also observed macula densa. The macula densa cells observed in this study were shorter than rest of the cells of DCT and were closely packed with crowded nuclei and dark stained cytoplasm. This finding was in agreement with that of Nishimura *et al.* (1986) who observed macula densa with relatively smaller cells and compact nuclei in Japanese quail. Macula densa cells were in contact with lacis cells (Fig.4) as observed by Aeikens and Hildebrand (1981) in rat kidney. These cells are believed to be important in regulating blood flow to glomerulus. Siller (1971), Barajas (1979) and Kon *et al.* (1984) in fowl kidney and Casotti and Richardson (1993) in honey eater kidneys noted crowding of nuclei in macula densa cells. Christensen *et al.* (1982) observed taller macula densa cells in domestic fowl. Contrary to this, Hodges (1974) observed that nuclei of macula densa cells of fowl kidney were not crowded.

The afferent arteriole was larger than the efferent arteriole similar to the findings of Casotti and Braun (1995) in kidney of domestic chicken and desert quail. In the present study, juxtaglomerular cells were observed on the wall of afferent arteriole near macula densa, as epitheloid cells with dark staining cytoplasm (Fig.4).

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