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COMPARATIVE MICROANATOMICAL FEATURES OF THE RENAL CORTEX IN EMU (*Dromaius novaehollandiae*) AND DUCK (*Anas platyrhynchos*)

K. Archana*[1], Y. Nagamalleswari[2], N.K.B. Raju[3], P.V.S. Kishore[4], G.S.S. Chandana[5] and K. Raja[6]

[1]Assistant Professor, [2]Professor, [3]Associate Professor, [4]Professor and Head, [5]Assistant Professor, [6]Assistant Professor

Department of Veterinary Anatomy, NTR CVSc, Gannavaram, 521102, India

E-mail: drarchanakiran@gmail.com (**Corresponding Author*)

Abstract: The present study was conducted on each of the three adult birds of Emu and Duck procured from the farms located in and around Gannavaram. The renal parenchyma of Emu and Duck was divided into large cortical lobules and smaller medullary lobules/cones. The renal cortex of both the birds showed a labyrinth of tubules and renal corpuscles. Small loopless cortical (reptilian type) nephrons and larger looped juxtamedullary (mammalian type) nephrons were observed. The cortical renal corpuscles were found to be numerous than the juxtamedullary nephrons in both the birds. The number of reptilian type of nephrons in Emu were relatively more in a given field area than that of Duck. Both types of renal corpuscles showed all parts of juxtaglomerular apparatus. The capsular space in the renal corpuscle of cortical and medullary nephrons of Emu were greater than that of Duck. Proximal convoluted tubules were lined by high cuboidal cells with spherical nuclei located at the basal level in Emu and Duck. Distal convoluted tubules and collecting tubules in both the birds were lined by low cuboidal cells. Except at the vascular pole the lumen of the distal convoluted tubules in Duck were wider than those of Emu. Numerous peritubular sinuses lined by simple squamous epithelium were observed which drained into the interlobular veins. Lymphoid aggregations were observed between the renal tubules of both the birds.

Keywords: Emu, Duck, Renal cortex.

INTRODUCTION

The role of kidney in osmoregulation and excretion in birds is not as well defined as it is in mammals. Inter specific variation in renal microstructure appeared to be a major factor determining the efficacy of water economy in birds of different habitats. The Emu, a large flightless bird, has low water requirements yet it has a limited ability to produce concentrated urine The present study was conducted to compare the histological differences in the kidneys of Emu and Duck (as a pattern of aquatic birds).

MATERIALS AND METHODS

The tissue samples of kidneys of three each from the adult Emu and Duck were collected and preserved in 10 % neutral buffered formalin. They were processed for routine paraffin

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techniques (Singh and Sulochana, 1996) and were further subjected to various staining techniques. The present investigation was carried out in the Department of Anatomy, NTR College of Veterinary Science, Gannavaram, Andhra Pradesh, India.

RESULTS AND DISCUSSION

The kidneys of Emu were elongated and were located in the iliac fossa along the ventral surface of the synsacrum and those of Duck were flattened organs which extended from the ventral aspect of the lungs to the end of the synsacrum occupied in the iliac fossa. Each kidney consisted of cranial, middle and caudal lobes. In the Duck cranial lobe was small round-oval in shape and the caudal lobe was the largest and most elongated. In the Emu the three lobes of the kidney were clearly demarcated and the cranial lobe bulges more than the others (Nabipou et.al., 2009). Kidneys of both the birds were invested by a well defined thin capsule made up of mainly collagen fibres and a few elastic fibres. The capsule was positive to PAS.The renal parenchyma were divided into numerous lobules. The interstitial tissue was scanty and was made of a few collagen and reticular fibres. Each lobule was composed of two zones namely the cortex (outer area) and medulla (inner area). However the cortex formed the majority of the kidney, while the medulla formed only a portion of the organ which was similar to the findings of Michalek et.al., (2016) and Warui (1989). The cortex revealed two types of nephrons, mammalian and reptilian type wherein the glomeruli of the former were larger in diameter and their tubules showed Henle's loops (Fig.01). However the reptilian type of nephrons were comparatively more than in Emu than in Duck (Fig.02). There was a typical horse shoe pattern arrangement of the glomeruli around a central vein in the Kidney of Emu whereas such arrangement was not much evident in Duck (Fig 03). Each renal corpuscle consisted of an outer Bowman's capsule separated from a centrally located glomerulus by Bowman's space. However the capsular space was comparatively more in Emu than in Duck (Fig.04). The renal glomeruli contained a tuft of capillaries and centrally located large central mass of mesangial cells. The Proximal convoluted tubules were lined by high cuboidal epithelium with a large spherical nucleus located in the basal half of the cell. The luminal surface of the epithelial cells formed the brush border membrane which was formed by a thick layer of microvilli which is in accordance with the findings of Richardson et.al., 1991 and Batach.,2012. In between these tubules, peritubular capillary sinuses were observed in both the birds. Distal convoluted tubules were also lined by cuboidal cells but had no brush border and their lumen were more clearly defined. However the distal convoluted tubules of Duck were wider than in Emu (Fig.05).The macula densa was observed at the initial part of the distal convoluted tubule and was closely situated at the vascular pole of the glomerulus in both the birds. The medulla was arranged in discrete medullary structures named cones, which were randomly distributed in the kidney. The medullary cones of Duck were cup shaped and comparatively smaller than those of Emu (Fig.06). Collecting ducts lined by columnar epithelium located between the thick and thin limbs of Henle were observed in the peripheral portion of the cortex and renal medulla of both the birds. Lymphatic aggregations were observed in the renal cortex of few birds which suggest the role of kidney as a lymphoid organ which is in accordance with Sivakumar et.al., 2012.

The findings like more number of reptilian type of nephrons, wider capsular space support certain authors like Dawson et.al.,1991 who stated that Emu has a relatively limited capacity to concentrate urine resulting from specific morphology and that the role of Emu kidneys was secondary in the final regulation of water and NaCl excretion. In the Emu cloacal-rectal epithelium has considerably higher rates of water and electrolyte absorption (Michalek et.al., 2016). The findings suggest that in Emu the cloaca-rectum is the primary organ of osmoregulation (Dawson et.al., 1991).

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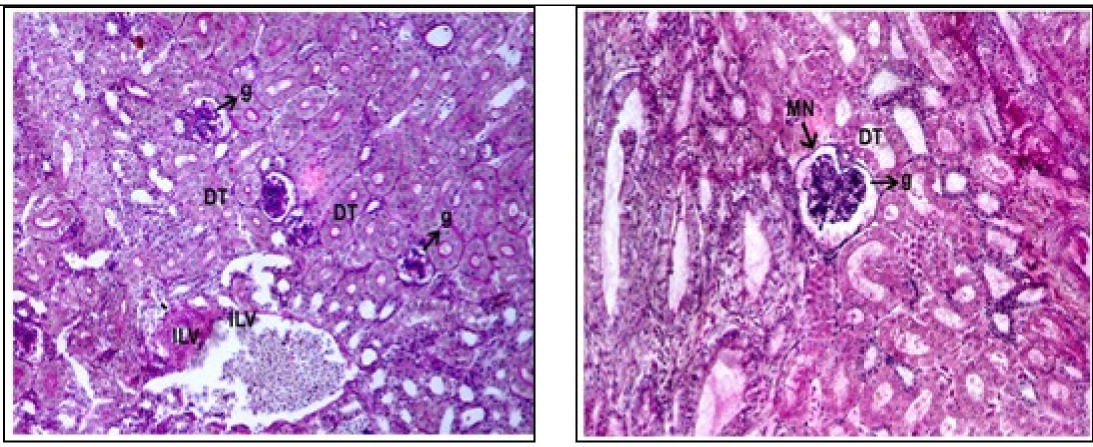
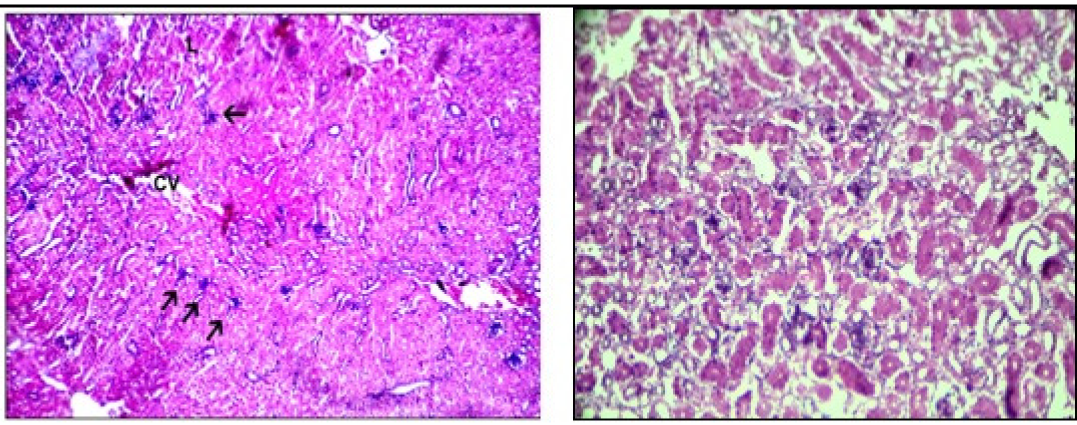
ILLUSTRATIONS



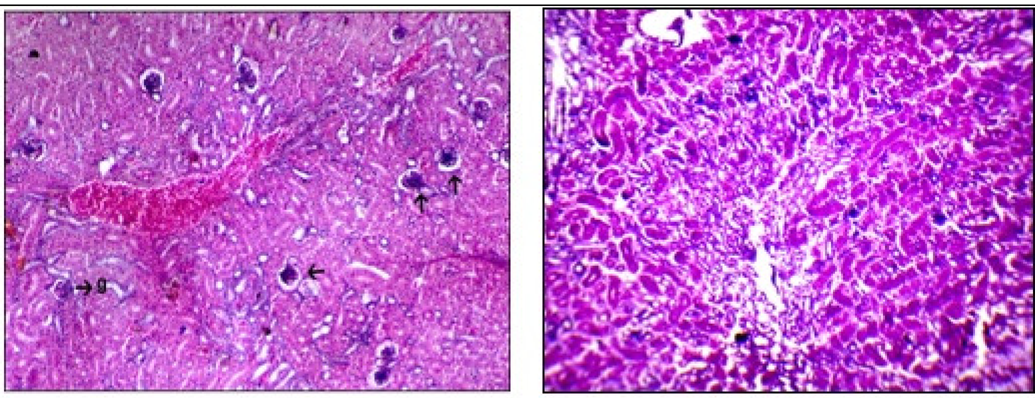
Emu

Fig.01.Mammalian type of nephrons (MN) showed larger diameter than reptilian type (RT). H&E 20X



Emu Duck.

Fig.02. Reptilian type of nephrons (Arrows) were relatively numerous in Emu than Duck. H&E 20X



Emu Duck.

Fig.03.Nephrons showed horse shoe pattern of arrangement around central vein in Emu (H&E 20X) while such arrangement was not observed in Duck (H&E 10X)

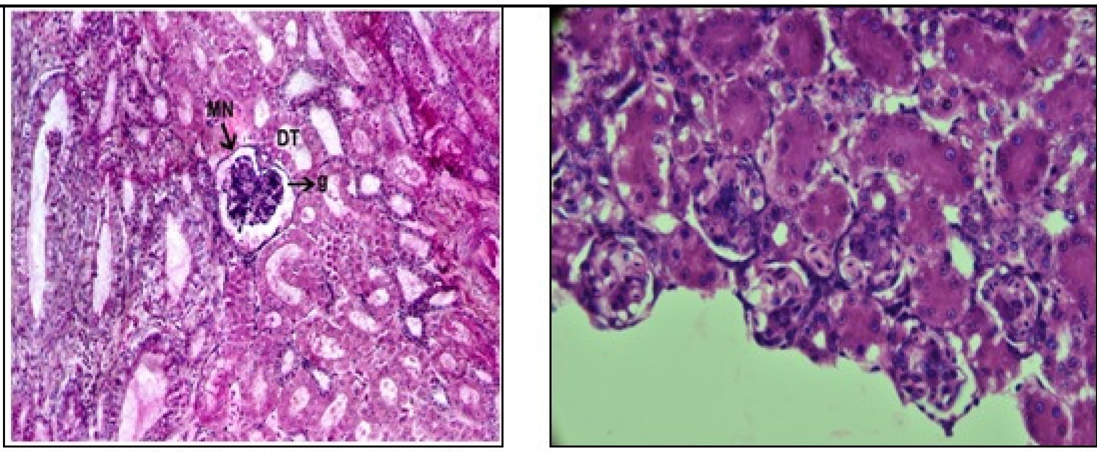


Fig.04.Capsular space was more in Emu (H&E 20X) than in Duck (H&E 40X).

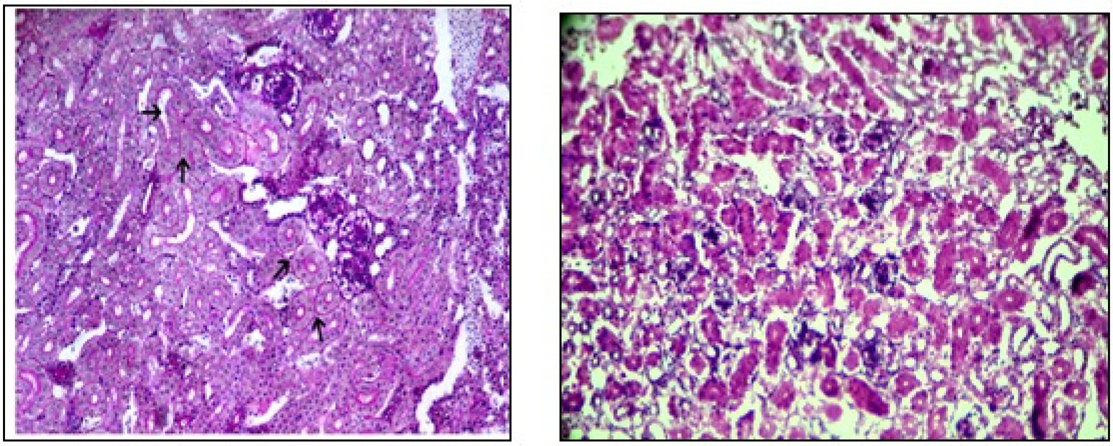


Fig.05. Distal convoluted tubes were wider in Duck (H&E 10X) than in Emu (PAS 10X)

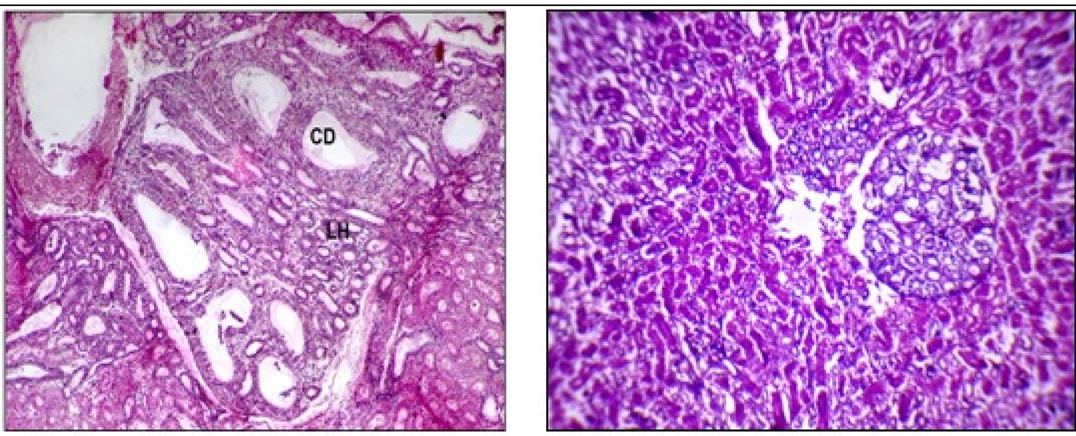


Fig.06. Medullary cones of Duck (Masson,s Trichrome 40X).were smaller and cup shaped where as they were wide spread in Emu. (H&E 20X)