



RESEARCH ARTICLE

MORPHOLOGICAL & HISTOLOGICAL STUDY OF THE KIDNEY IN GUINEA PIG

Hassaneen A.Al-Sharoot

Department of Anatomy and Histology -College of Veterinary Medicine Al-Qadisiyah University

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Corresponding Author

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Hassneen Ali.Al-sharoot

Abstract

The present work includes anatomical and histological study of the kidney of guinea pig. The current study was performed on (10) kidneys from (5) mature (male and female) guinea pig clinically healthy. The animals were anaesthetized by the ether after which they were carefully dissected and examined.

The anatomic studies showed the urinary system of guinea pig was composed of two kidneys. The kidneys are retroperitoneal organs bean in shape, red pink in colour and situated in the posterior part of the abdomen on each side of the vertebral column. The mean weight of right and left kidney (0.205 ± 1.998) mm. The mean length, width and thickness of right kidney (20.356 ± 0.850) mm, (14.396 ± 830) mm, (8.198 ± 0.450) mm respectively. While the mean length, width and thickness of left kidney (18.296 ± 0.722) mm, (13.776 ± 0.939) mm, (8.192 ± 0.440) mm respectively. The cross section of kidney showed two anatomical distinct regions, the outer cortex and inner medulla, both terminate by renal papilla. The renal cortex is reddish brown in colour. The mean width of cortex and medulla of right kidney (5.554 ± 0.371) mm, (5.508 ± 0.180) mm respectively while the mean width of cortex and medulla of left kidney (5.780 ± 1.792) mm, (5.492 ± 0.205) mm respectively. The result of histologic study demonstrate the kidney consist of outer dark red region (cortex) and inner lighter colored region (medulla) there is no evident boundary between the cortex and medulla. The renal corpuscle (malpighian) is aspherical structure formed of glomerulus, which is enclosed by a double-walled Bowman's capsule. Proximal convoluted thin tubules characteristic by have widest lumen and internally lining by cuboidal epithelial cells which resting on the basement membrane. This cells characterized by have ground eosinophilic cytoplasm, large centrally nuclei and the apical surface covered by a brush border called microvilli. While the epithelial lining of distal convoluted tubules have extensive lumen and cuboidal cells have ground cytoplasm was clearly less eosinophilic than that of the proximal tubules and the apical surface of the distal convoluted tubule was uncovered by short microvilli.

INTRODUCTION

The experimental animals (mouse, rat, guinea pig and monkey) play important role for answering many problems in human medicine because the anatomical structure of the kidneys of different experimental animals was studied in order to understand the anatomical structure of human kidney (1, 2) because their anatomy and physiology resemble with human kidneys (3).

The principle function of urinary system is conservation of water and electrolyte homeostasis and the second major function of this system is the excretion of many toxic metabolic waste products particularly the urea and creatinine (4).

The kidneys are complex organs play important role in removal of unwanted nitrogenous substances, excess water and relative maintenance of osmotic concentration

of the blood (5, 6). The present study was understand morphometric parameters and histology of the normal kidney in guinea pig, this help to provide base line information .

Material and Methods

The Experimental Animals

The material was consisted of 10 kidneys from five mature (male and female) clinically healthy of guinea pig. Guinea pigs were collected from a local commercial market of animals in Baghdad city weight between 500g and 800g. The animals were anaesthetized by the ether after which they were carefully dissected and examined

Anatomotopographic study

In this study, left and right kidneys were collected by abdomino-sternal approach. The biometrical parameters including (weight, length, width circumference and thickness of right and left kidneys) were recorded. The length, width and thickness of the kidneys were measured by use digital vernier calipers. Then the kidneys were bisected longitudinally to expose the inner structures subsequently, the thickness of cortex and medulla were estimated with the help of digital vernier calipers (7). The results were documented with digital camera HTC (japan).

Histologic study

Specimens for histology were collected immediately after gross examination .The specimens were fixed in 10% formalin for about 24 hours. The samples preserved in 70 % ethyl alcohol dehydrated in graded series of alcohol, cleared in xylene and embedded in paraffin wax as usual. Sections of 4-6 μ thickness were mounted on clean glass slides and stained with the haematoxylin and Eosin (H &E) for general structure

Results

Gross study

The urinary system of guinea pig was composed of two kidneys. The kidneys are retroperitoneal organs bean in shape, red pink in colure and situated in the posterior part of the abdomen on each side of the vertebral column. They are attaching to the posterior extremity of the adrenal gland at the respective side. The right kidney was rostral and craniomedially to the left kidney and the cranial pole of the right kidney had impression on the caudal lobe of the liver. The kidneys are enclosed by a fibro connective smooth capsule and adipose tissue surrounding the hilus and sides of each kidney fig (1). Each kidney had cranial, caudal surface, medial, lateral border, upper and lower pole. The lateral border was convex in shape while the medial border was concave (2). The mean weight of right and left kidney

(**0.205 \pm 1.998**) mm. The mean length, width and thickness of right kidney (**20.356 \pm 0.850**) mm, (**14.396 \pm 830**) mm, (**8.198 \pm 0.450**) mm respectively table (1). While the mean length, width and thickness of left kidney (**18.296 \pm 0.722**) mm, (**13.776 \pm 0.939**) mm, (**8.192 \pm 0.440**) mm respectively table (2). The cross section of kidney showed two anatomical distinct regions, the outer cortex and inner medulla, both terminate by renal papilla. The renal cortex is reddish brown in colour. The mean width of cortex and medulla of right kidney (**5.554 \pm 0.371**) mm, (**5.508 \pm 0.180**) mm respectively table (1) while the mean width of cortex and medulla of left kidney (**5.780 \pm 1.792**) mm, (**5.492 \pm 0.205**) mm respectively table (2).

Histologic study

Observations the kidney consist of outer dark red region (cortex) and inner lighter colored region (medulla) there is no plain boundary between the cortex and medulla fig(3). Microscopically the kidney is a compound tubular gland formed of components of the nephron includes the renal or (malpighian), the proximal convoluted tubule, the distal convoluted tubule, and the connecting tubule. The renal corpuscle (malpighian) is a spherical structure formed of glomerulus, which is enclosed by double-walled layers called (Bowman's capsule). Bowman's capsule has two layers visceral and parietal layers fig (4). The internal or visceral layer surrounds the glomerular capillaries with modified epithelial cells called podocyte. The space between the visceral layer and the parietal layer of the renal corpuscle is called the capsular (urinary) space fig (4). Proximal convoluted tubules are thin structures carctrestic by have widest lumen and internally lining by cuboidal epithelial cells which resting on the basement membrane. This cells characterized by have ground eosinophilic cytoplasm, large centrally nuclei and have apical surface covered by a brush border called microvilli. While the epithelial lining of distal convoluted tubules have extensive lumen and cuboidal cells have ground cytoplasm was clearly less eosinophilic than that of the proximal tubules and the apical surface of the distal convoluted tubule was uncovered by short microvilli. Also found in the cortex are the medullary rays. The medullary rays include the following three types of tubules straight (descending) segments of the proximal tubules, straight (ascending) segments of the distal tubules and the collecting tubules. The straight (descending) of the proximal tubules are much related in the structure to the proximal convoluted tubules while the straight (ascending) segments of the distal tubules are like to the distal convoluted tubules fig (5). The medulla contains only straight parts of the tubules and henle loop. Henle loop is the structure consists of (thick and thin descending segments and thin and thick ascending segments

Table1/ Measurements of Length, Width, Thickness, Width of Cortex and Medulla of Right Kidney

Length of kidney	Width of kidney	Thickness of kidney	Width of cortex	Width of medulla
20.356± 0.850	14.396 ±0.830	8.198±0.450	5.554±0.371	5.508±0.180

Table 2 measurements of length, width, thickness of kidney, width of cortex and medulla of left kidney.

Length of kidney	Width of kidney	Thickness of kidney	Width of cortex	Width of medulla
18.296± 0.722	13.776± 0.939	8.192±0.440	5.78 0±1.792	5.492±0.205

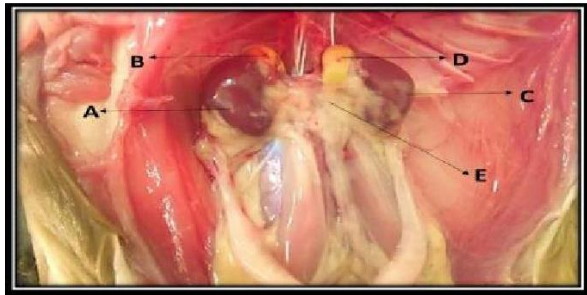


Fig (1) Photograph section ventral view anatomical position

A-Right kidney ,B- Right adrenal gland ,C- left kidney ,D- left adrenal gland E- Adinose tissue

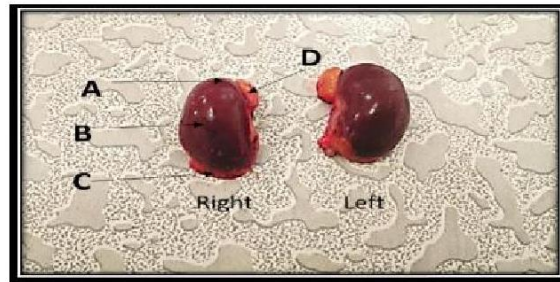


Fig (2) Photograph section anatomical position, shape and color of kidney

A- Lateral border, B- Cranel surface, C- Medial border
D- Adrenal gland

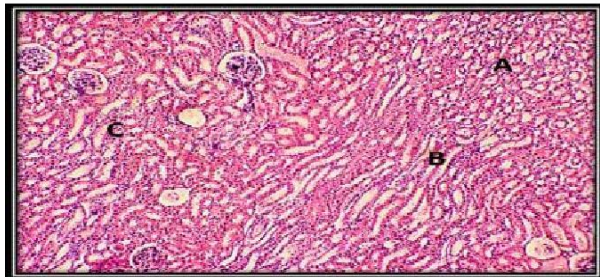


Fig (3) Transverse section in kidney stain (H&E×100)

A-Cortex, B- Medulla, C-corporuscle

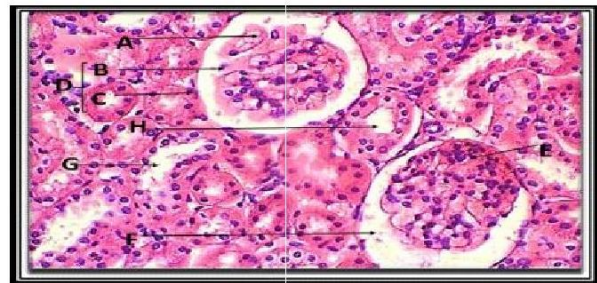


Fig (4) Transverse section in cortex stain (H&E×400)

A-Glomerulus, B- visceral layer, C – parietal layers- Bowman's capsule,
E-Podocyte , F- Capsular space,G- convoluted tubule, H- proximal convoluted

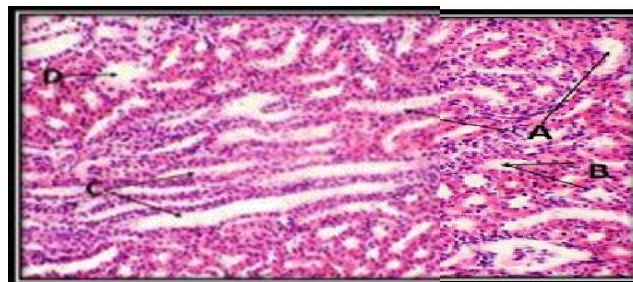


Fig (5) Transverse section in cortex stain (H&E×400)

A-Straight (descending) B- Straight (ascending) C- collecting tubules
D-Henle loop

DISCUSSION

The anatomical studies demonstrate urinary system of guinea pig was composed of two kidneys. The kidneys are retroperitoneal organs bean in shape situated in the posterior part of the abdomen on each side of the vertebral column. The present observations are consistence with that observation of (8) in all mammals and (9) in desert rodents. The study confirmed the right kidney was rostral and craniomedially to the left kidney, the irregular of the kidneys localization on each side of the vertebral column due to relative variation in growth of different organs in the abdominal and pelvic cavities during various phases of embryonic development ,that is agreement with the (10, 11) in laboratory animal while disagreed with the (12) who determine localization of the kidneys in rabbets correspond on the lumbar vertebrae and unlike with the (13) who presented disposal of the kidneys dependent of the level of artery vessel because not use artery vessel marker for the determine disposal of the kidneys

.Also the results of this study showed slight difference between measurements of right and left kidney, these differences in values could be due to variations in age, breed and environmental factors including the diets. The values in this study were also similar to those of (14) in laboratory rat.

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