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RESEARCH ARTICLE

Identification, Architecture & The Gross Structure of the Kidney in Adult Local Breed Ram in Iraq (*Ovis ovis*) by Using Corrosion Cast & Latex Techniques.

Nabeel Abd Murad AL-Mamoori[1*], Maha Abdul-Hadi Abdul- Rida[2] and Saffia Kareem Wally Alumeri[3]

Department of Anatomy and Histology, College of Veterinary Medicine, University of AL-Qadisiyah, Iraq.

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[*]**Address for Correspondence**
Nabeel Abd Murad AL-Mamoori
Department of Anatomy & Histology,
College of Veterinary Medicine,
University of AL-Qadisiyah, Iraq
Email : Nabeel.almamorri@qu.edu.iq

ABSTRACT

Used ten specimens in the present study to distinctive anatomical, morphometric and blood supply features of the kidneys in adult ram (Ovis *ovis*) by using corrosion cast and latex injection techniques. The kidney was bean shape, brown in color and smooth consist from two surfaces, two borders and two pols. The mean weight, length, width, thickness, length medial and lateral borders of the right kidney was 58.003± 2.74, 6.5± 0.20, 4.075± 0.11, 3.075± 0.04, 9.22± 0.48 and 11.675± 0.29, while the mean weight, length, width, thickness, length medial and lateral borders of the left kidney was 58.237± 0.07, 6.575± 0.5,3.825± 0.37,3.1± 0.14 , 8.825± 0.27 and 10.8± 0.26 respectively. The parenchyma of the kidney divided into many regions differ in the color and texture was capsule, cortex and medulla.The renal pelvis a wide origin of the ureter within the kidney take saddle shape extend in horizontal plane at the level of renal crest and apex of renal pyramid. It send extension toward the renal pyramid refer to major and minor calyces. The renal artery divided into 2-3 segmental arteries. The segmental artery divided into 6-7 branches called interlobar artery. The interlobar arteries give the arcuate artery. The arcuate artery gives off several branches of the cortical radiate artery. The renal vein divided into 3-4 of segmental veins. The segmental vein divided into 6-7 branches called interlobar vein. The interlobar vein divided into the arcuate vein. The arcuate vein give off several branches of the cortical radiate vein.

Keywords: Kidney, morphology, corrosion cast, latex, ram, *Ovis ovis.*

INTRODUCTION

The Sheep were regarded an important source of production of wool, meat and milk (1).The Awassi breeds have wide spread throughout the Asia area and the greater numbers of Awassi is found in Iraq. It is numerically the most important sheep and concentrated in the middle of the country (2).The total number of sheep in Iraq at 1980 (8,526,480) and (21,526) in AL-Qadisiyah province (3). The urinary system consists of two kidneys (right and left), two ureters (right and left), urinary bladder and urethra. The kidneys play very an importance role in maintenance homeostasis and excretion of metabolic waste products and other functions such as syntheses and secretions hormones renin and erythropoietin (4 and 5). It is located in the dorsal part of the abdominal cavity on each side of the caudal vena cava and abdominal aorta. In the most domestic animals the right kidney extend cranial more than left kidney. The kidneys in the most animal bean shape with smooth surface except in the cattle are lobulated with rough surface (6 and 7). This study design to providing anatomical information and data about the kidney in adult rams by using corrosion cast technique and latex injection technique.

MATERIALS AND METHODS

Morphological and biometrical study

Used ten specimens of the kidney of adult rams. It collected from AL-Diwaniyah abattoir immediately after slaughtering the rams. Make incision from thoracic inlet into the pelvic cavity and removed the internal organs to exposure the kidney. Dislocation of the kidneys with kept on the major blood vessels which supply the kidney (renal artery and vein) and part from ureter. Removed the adipose tissue which covered the kidneys and washing the kidneys by using tap water to remove the some of the impurities found. Finally recorded the weight, length, width and thickness of right and left kidneys.

Corrosion cast technique

Used this technique to exposure the internal appearance of blood vessels and ureter by following steps:

1. Inject the renal artery, vein and ureter with warm normal saline solution 0.9 % or tap water to cleaning and discharge the clot or sediment which may be found in the blood vessels or ureter, let the specimen five minutes after injection with warm water.
2. Inject the renal blood vessels and ureter by mixture of self-cure denture material set (Powder and liquid 1 to 4), It consist of 20% monomethyl-methacrylate powder and 80% polymethyl-methacrylate liquid and adding the suitable dyes (Red, blue and yellow ballpoint pen ink) to differentiate the blood vessels and the ureter (8).
3. Let the specimen at room temperature for 24 hours for polymerization.
4. Put the specimen in drain opener (It consist of a mixture of NaOH, Na2CO3 and NaClO take a granules shape dissolved 1 kg of drain opener in 5 liters of tap water) in at the room temperature for 72–96 hour to corrosion casted.
5. Washing the specimens with tap water and photographed.
6. Finally, to exposure the internal shape of the blood supply and renal pelvis put the polymerized kidney in square container and adding enough amount from tap water and freezing after that make longitudinal section by using special saw.

Latex techniques

Used this technique to exposure the external appearance of blood vessels by following steps:

1. Inject the renal artery and vein with warm normal saline solution 0.9 % or tap water to cleaning and discharge the clot or sediment which may be found in the blood vessels, let the specimen five minutes after injection with warm water.
2. Inject the renal artery and vein with the red colored latex substance (2 : 3 latex with ammonia mixed with carmine stain) using blunt needle and syringe.
3. Used small pieces of tissue paper to prevent any leakage of latex from the damaged small arteries by pressing on the site of oozing.
4. Put the specimens in 10% formalin for 24 hour to fixed the tissue and setting of the injected material.
5. Finally made longitudinal section of the kidney to exposure the blood supply of the kidney by dissecting the blood vessels carefully and photographed.

RESULTS

Morphology of Kidney

External Appearance of the Kidney

The kidneys (right and left) was bean shape, brown in color and smooth from outer surface embedded within adipose tissue. Each kidney consists from two surfaces (dorsal and ventral), two borders (lateral and medial) and two pols (cranial and caudal). The dorsal surface was strongly convex and the direction toward the vertebral columns, while the ventral surface slightly convex and toward the abdominal viscera. The medial border was concave in the middle region to formation the hilum to enter the renal artery with nerve and leave the renal vein and ureter while the extremities of border convex (Fig.1). The hilum was depression area connect the renal sinus where the ureter found, artery, vein, nerves and lymph vessels are pass through it. It can be see extend on ventral surface more than dorsal surface. The medial border of the right kidney toward the caudal vena cava, while the medial border of the left kidney toward the abdominal aorta. The lateral border convex from side to side (Fig.1). The mean weight, length, width, thickness, length medial and lateral borders of the right kidney was 58.003± 2.74, 6.5± 0.20, 4.075± 0.11, 3.075± 0.04, 9.22± 0.48 and 11.675± 0.29, while the mean weight, length, width, thickness, length medial and lateral borders of the left kidney was 58.237± 0.07, 6.575± 0.5 , 3.825± 0.37, 3.1± 0.14 , 8.825± 0.27 and 10.8± 0.26 respectively (Table. 1).

Internal Appearance of the Kidney

To show the internal structure of kidney make longitudinal section of the parenchyma of the kidney can be see many regions or layers differ in the color and texture was capsule strong a fibrous membrane layer, transparent cover the outer surface of the kidney and easily dislocation resembling nylon bag (Fig.2). The cortex located beneath the capsule rough texture, brown in color and take radiate appearances which consist from cortical artriol and veniole. The cortex send part of it called renal columns toward the medulla separated renal pyramid. The medulla located ventral to cortex dorsal to renal pelvis, rough texture, light-brown in color, it divided into many regions pyramidal in shape called renal pyramid (Fig.2,3,10&11). The renal pyramid part of medulla has pyramidal in shape, it consist of base and apex, the base toward the cortex while the apex toward the renal pelvis.The apex of pyramid form renal papillae which refer to apical portion of the pyramid which projection in the minor calyces of the renal pelvis. It form the horizontal ridge of the medulla formed of the fusion of the renal papillae that projects into the renal pelvis called renal crest (Fig.2,3,10&11).The renal pelvis a wide origin of the ureter within the kidney. It is located in the renal sinus receives the urine from the renal papillae and transport into the ureter. When inject with cast resin the renal pelvis take saddle shape extend in horizontal plane at the level of renal crest and apex of renal pyramid. The renal pelvis see send extension toward the renal pyramid resemble the butterfly wings closed this refer to major and minor

calyces which surrounded the renal pyramid. The region between the extension (butterfly wings closed) see the blood vessels pass through it (Fig.2,3,7,8 and 9).

Blood supply of Kidney

By uses the corrosion cast technique and latex injection technique can be seen the blood vessels that supply the kidneys and as following**:**

Renal artery

The abdominal aorta give arises two branches of renal artery from the ventral side of it, to supplies the right and left kidneys through the hilum (Fig.1). The renal artery when reaches into entrance of the hilum of kidney divided into 2-3 segmental arteries (Fig.4,6,7 and13). The segmental artery extend into short distance &when reaches into the apex of the renal pyramid divided into 6-7branches called interlobular artery that supply medulla region (Fig.7,12&13).The interlobular arteries pass through the renal columns between the sides of renal pyramid and form the external boundaries of it which resemble the network of arteries. When it reaches into the base of the renal pyramid give branch extend along the base resemble of arch called arcuate artery (Fig.7,10 and 13). The arcuate artery extend along the renal pyramid and give off several branches extend toward the cortex has radiate shape called cortical radiate artery that supply cortex region and capsule (Fig. 4,6,7,10,11,12 and 13).

Renal vein

The caudal vena cava give arises two branches of renal vein from the ventral side of it, which enter the kidney through the hilum of kidney (Fig.1). The course of renal vein resemble of the renal artery.The renal vein when reaches into entrance of the hilum of kidney divided into 3-4 of segmental veins (Fig.5,6,7,8 and 13). The segmental vein extend into short distance with segmental artery in the same course and when reaches into the apex of the renal pyramid divided into 6-7 branches called interlobular vein (Fig.7,8 and 13). The interlobular vein pass through the renal columns with interlobular artery and form the external boundaries of the renal pyramid. When it reaches into the base of the renal pyramid give branch extend along the base resemble of arch called arcuate vein(Fig.7,8,12 and13).The arcuate vein extend along the base of renal pyramid in the same course of arcuate arteries and give off several branches extend toward the cortex take radiate shape called cortical radiate vein(Fig.7,8,10,11,12 and 13).

DISCUSSION

Morphology of Kidney

The kidney was bean shape, brown in color and smooth from outer surface. Each kidney consist from two surfaces, two borders, two pols and this result agreement with 6,7 and 9in small ruminants, horse, dog & cat, and disagreement with 7,9 and 10 in bovine show the kidney is lobulated ovoid in shape, while in one humped camel the kidney has smooth surface bean–shaped with grayish.The mean weight, length, width, thickness, length medial and lateral borders of the right kidney was 58.0035±,6.5±,4.075±,3.075±,9.225±,and 11.675±, while the mean weight, length, width, thickness, length medial and lateral borders of the left kidney was 58.237± , 6.575± , 3.825± , 3.1± , 8.825± and 10.8± respectively and this result disagreement with 12 show the mean weight, length, width, thickness, length medial and lateral borders of the right kidney was 66.41, 6.10, 3.60, 2.29 , 10.88 , and 11.87 cm, while the mean weight, length, width, thickness, length medial and lateral borders of the left kidney was 65.67, 6.30, 3.59, 2.20, 11.80 and 11.83 respectively in goat, this differ may be due to type and age of animal.The renal pelvis is a wide origin of the ureter within the kidney. The renal pelvis see send extension toward the renal pyramid resemble the butterfly wings closed this refer to major and minor calyces which surrounded the renal pyramid. This result agree with 7 and 9

show the renal pelvis bifurcated to major calices and then to miner calices, except in large ruminant where the major calices attached directly to the ureter. This differ due to structure and type of kidney (unilobular or multilobar).

Blood supply of kidney

The renal artery arises from the ventral side of abdominal aorta and before entrance of the hilum of kidney divided into segmental artery, this result agree with 6,7,13,14 and 15 in sheep, buffalo, dog and horse. But disagree with 16 explain found the accessory renal arteries originating directly from aorta out of 100 specimens, it is recorded as 2%. The segmental artery has 3-4 branches extend into short distance and when reaches into the apex of the renal pyramid each one divided into 6-7 branches called interlobar artery that supply medulla region this result agree with 17 in goat show the segmental artery divided into 4 division, but disagree with 12 and 17 in buffalo show the number of interlobular artery 4-5 while 14 show the renal artery in kangal dog divided into two branch dorsal and ventral branch. The right dorsal artery gave 5 to 6 segmental arteries, while the right ventral artery give 4 to 6 segmental arteries, but the left dorsal artery give off 5-7 segmental arteries and the left ventral artery 6 to 8 segmental arteries. These differ due to species of animal. The interlobular arteries pass through the renal columns between the sides of renal pyramid and give arcuate artery, this result agree with 9. The renal vein when divided into 3-4 of segmental veins. The segmental vein extend into short distance with segmental artery in the same course divided into 6-7 branches called interlobular vein. This result disagree with 18 in pig show renal vein divided into cranial, middle and caudal renal veins. Each one branched into 8-9 interlobar veins. The interlobular vein pass through the renal columns with interlobular artery and branched into arcuate vein This result agree with 18 in pig.

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Table 1: Biometrical observation in right and left kidney in adult ram. Mean and stander error

The parameter	Right kidney	Left kidney
Weight	58.003 ± 2.741	58.237 ± 0.070
Thickness	3.075 ± 0.047	3.1 ± 0.143
Wide	4.075 ± 0.110	3.825 ± 0.375
Length of kidney	6.5 ± 0.204	6.575 ± 0.507
Length of medial boarder	9.225 ± 0.488	8.825 ±0.273
Length of lateral border	11.675 ± 0.296	10.8 ± 0.263

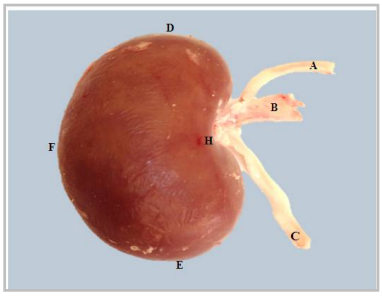

Fig. (1) External Appearance of the Kidney in Ram Show: A- Renal artery. B- Renal vein. C- Ureter. D- Cranial pole. E- Caudal pole. F- Lateral border. H- Hilum in the medial border.

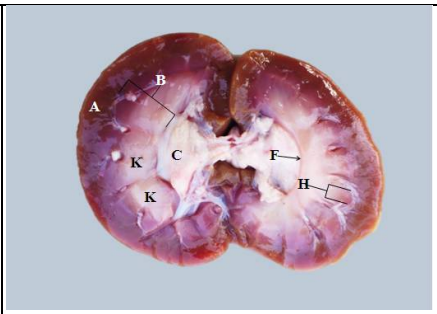

Fig.(2) Internal Appearance of the Kidney in Ram Longitudinal Section Show: A- Cortex, B- Medulla,C- Renal pelvis, F- Renal crest,H- Arcuate artery, K- Renal pyramid.

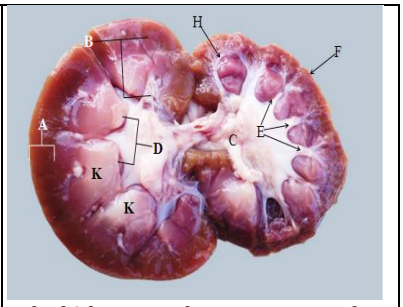

Fig.(3) Internal Appearance of the Kidney in Ram Longitudinal Section Show: A- Cortex. B- Medulla. C- Renal pelvis. D- Renal papillae. E- Minor calyxes. F- Capsule. H- Arcuate artery. K- Renal pyramid

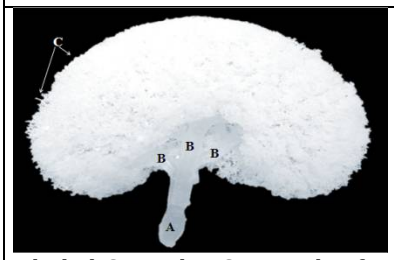

Fig.(4) Corrosion Cast Resin of Arterial supply of the Kidney in Ram Show: A- Renal artery. B- Segmental artery. C- Cortical artery

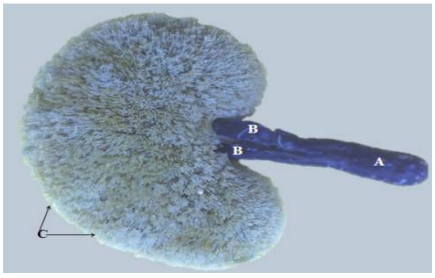

Fig.(5) Corrosion Cast Resin of Venous supply of the Kidney in Ram Show: A- Renal vein. B- Segmental vein. C- Cortical vein.

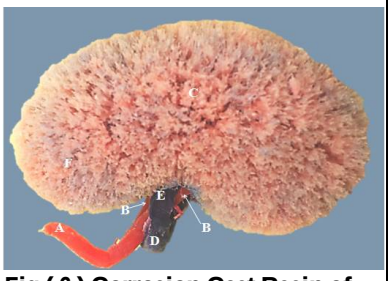

Fig.(6) Corrosion Cast Resin of Arterial and venous supply of the Kidney in Ram Show: A- Renal artery. B- Segmental artery. C- Cortical artery D- Renal vein. E- Segmental vein. F- Cortical vein.

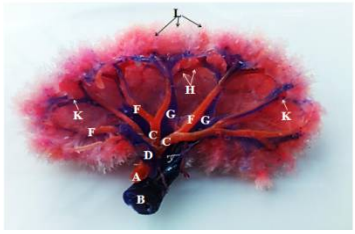

Fig.(7) Corrosion Cast Resin of the Blood supply of Kidney in Ram Longitudinal Section Show: A- Renal artery, B- Renal vein, C- Segmental artery, D- segmental vein. F- Interlobular artery, G- Interlobular vein. H- Arcuate artery. K- Arcuate vein, L- Cortical artery and vein.

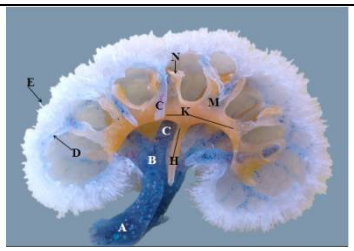

Fig.(8) Corrosion Cast Resin of Renal vein and Ureter of the Kidney in Ram Longitudinal Section Show: A- Renal vein. B- Segmental vein. C- Interlobular vein, D- Arcuate vein. E- Cortical vein, H- Ureter, K- Renal pelvis. M- Major calyces, N- Minor calyces.

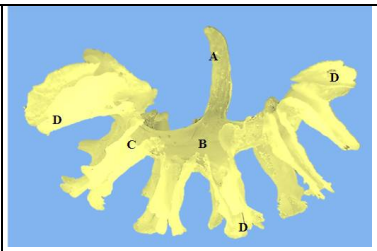

Fig.(9) Corrosion Cast Resin of Ureter and Renal pelvis of the Kidney in Ram Show: A- Ureter, B- Renal pelvis. C- Major calyces. D- Minor calyces.

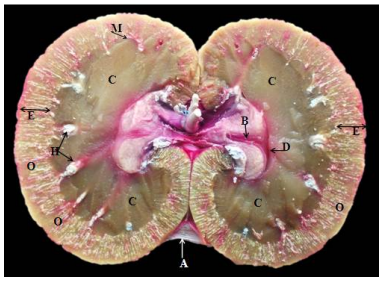

Fig.(10) Longitudinal Section of the Kidney in Ram used Latex with Carmine Stain Show:A- Capsule. B- Ureter. C- Medulla. D- Renal crest. E- Cortex.H- Interlobular artery. O- Cortical artery and vein. M- Arcuate artery.

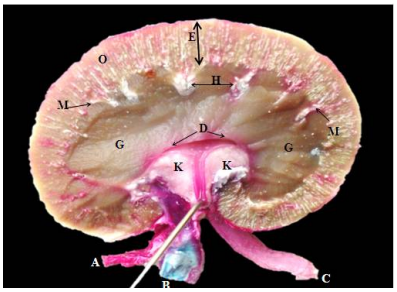

Fig.(11) Longitudinal Section of the Kidney in Ram used Latex with Carmine Stain Show: A- Renal artery. B-Renal vein. C- Ureter, D-Renal crest, E- Cortex. G- Medulla. H- Interlobular artery. K- Adipose tissue, O- Cortical artery and vein. M- Arcuate artery.

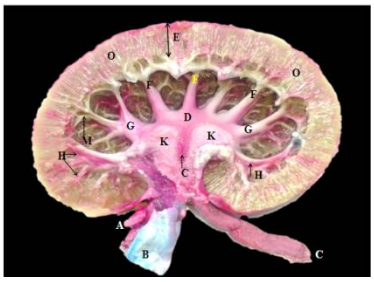

Fig.(12) Longitudinal Section of the Kidney in Ram used Latex with Carmine Stain Show: A- Renal artery. B-Renal vein. C- Ureter. D-Renal pelvis. E- Cortex. F- Minor calix.G- Major calix. H- Interlobular artery. K- Adipose tissue. O- Cortical artery and vein. M- Arcuate vein.

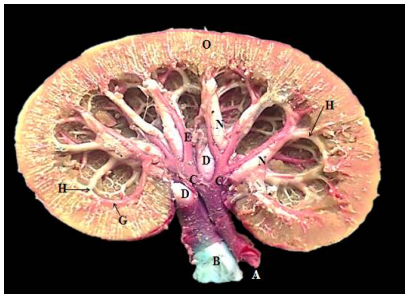

Fig.(13) Longitudinal Section of the Kidney in Ram used Latex with Carmine Stain Show: A- Renal artery, B-Renal vein. C- Segmental artery, D- Segmental vein,E- Interlobular artery,N-Interlobular vein. G- Arcuate artery.H- Arcuate vein,O- Cortical artery and vein.