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HISTOLOGICAL AND BIOCHEMICAL EVALUATION OF THE EFFICIENCY OF RABBIT KIDNEY AFTER PARTIAL OR RADICAL NEPHRECTOMY

Waleed J. A. Al-Kelaby[1], Hazem Almhanna[1], Hayfaa Jaber Hussein[2], Wasnaa M. Abdulridha[2] and Shurooq Wesam Al-Shaibani[2]

[1]Department of Anatomy, Histology and Embryology, Faculty of Veterinary Medicine, University of Kufa, Al-Najaf, Iraq.
[2]Department of Basic Science, College of Dentistry, University of Kufa, Al-Najaf, Iraq.
e-mail : hazemk.naser@uokufa.edu.iq, wasnaa.albaghdadi@uokufa.edu.iq

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ABSTRACT : In the current study, 30 adult male rabbits were used, rabbit was divided into two groups 10 in each group: group(A) was unilateral nephrectomy, while group (B) was partial nephrectomy; also, 10 rabbits were a control group (C). After 15 days 5 rabbit from groups (A, B and C) was killed and the anatomical, histological changes and biochemical analysis was conducted. After 30 days remain rabbits in all groups were killed and same parameters were studied.

Results showed anatomical and histological changes in both group A and B compared to control group (C) post operation. Kidneys (partially removed) were revealed different in shape, position and blood supply post operation in both groups(A) and (B) after healing and recovery, also hypertrophy of kidney was determined, but the filtrations and excretion of left kidney in a group (B) were still activated.

Histopathological changes of the kidney were identified in group (A) and Group B. Both groups showed that many changes in cortex and medullary region of kidney such as fibrous thickening area in capsular of kidney, dilation of cortical renal tubules and vacuolation of glomerular tuft and thick the walls of interstitial blood vessels. In addition, enlargement dilation of collecting renal tubules and released eosinophilic hyaline cast in the lumen.

These changes of tissue were observed in all subgroups of two groups (A) and (B). However, group (B), clearly was displayed calcifications in sections of the left kidney.

The biochemical analysis of the serum uric acid for all subgroups of both groups (A) and (B) showed that level of serum uric acid significantly increased at (P<0.05) compare with zero time and control. In same way, the level of the serum creatinine for group (A) and group (B) after 15 and 30 days were significant increase at (P<0.05) in comparison with zero time or control.

Key words : Creatinine, kidney, nephrectomy, partial, unilateral and uric acid.

INTRODUCTION

Anatomically kidneys are paired retroperitoneal organs which is in the posterior part of the abdomen on each side of the vertebral column. In human, the upper pole of each kidney is faced the twelfth thoracic vertebra and the lower pole opposite the third lumbar vertebra. Kidney has a medial or concave surface, which is called hilus, through it the renal pelvis, the renal artery and vein, the lymphatics, and a nerve plexus pass into the sinus of the kidney. The large curvature or lateral surface is smooth and curved (Dyce *et al*, 2009).

The renal arteries are supplied the kidney of rabbit, which is branched from the abdominal aorta. The venous blood of kidney is conveyed away from each kidney by a renal vein (Flešárová and Ma•enský, 2017). The internal structure of kidney is revealed two distinct regions, the cortex is located marginally and a pale outer region, while the inner region is a darker and called medulla (Samuelson, 2007). The major function of the kidney is depended on histological components of both regions and any changes in them lead to affect or dysfunction of the kidney.

Histologically, a kidney is protected by capsule which are collagens fibers and connective tissue, this capsule surrounded cortex of kidney and easily detached. A cortex is comprised with functional units of kidney are called nephrons which are filtered the blood from waste such as uric acid, water and other ions. The medulla is located internally to cortex toward hilus of kidney and divided

into 8 to 18 striated conical masses, the renal pyramids. The base of each pyramid is extended toward the renal pelvis to form a papilla that opens in the renal pelvis and continue with ureter (Eurell and Frappier, 2013; Bacha Jr and Bacha, 2012).

Kidneys are considered as the endocrine gland and produced hormones erythropoietin, calcitriol, and renin, as well as other hormones are involved and association with the functions of the kidney, such as angiotensin II, ADH and aldosterone (Singh and Williams, 2009; Coghlan and Tait, 2008; Menard, 2008).

Many diseases can be damaged kidneys in the human and animals and nephrectomy (removed total or partially of kidney) is performed on patients with acute severe damage of kidney due to diseases, injury, or congenital conditions. These include cancer of the kidney (renal cell carcinoma); polycystic kidney disease (a disease in which cysts, or sac-like structures, displace healthy kidney tissue); and serious kidney infections. It is also used to transfer a healthy kidney from donors to receivers by kidney transplantation operation in some clinical cases (MacKay *et al*, 1932; ADAMS *et al*, 1996). Subtotal Nephrectomy have been used with the surgical removal of the tumor and some of the surrounding kidney tissue to eradicate cancer and preserving as much of the functional units of the kidney which consider functional filter part of the kidney, this is known as "nephron- sparing surgery (Shamberger *et al*, 1998; Lane and Novick, 2007; Lau *et al*, 2000).

The creatinine is produced by the metabolic waste of muscle in the human and animals body and any diseases or damage of kidney by any reasons might lead to increase the level of it, and caused of accumulated it in kidney. Also, accumulation of creatinine cannot be excreted out by renal glomerular filtration process would be damaged the kidney and toxins of blood. The normal serum creatinine level of a human is 1.2 for women and 1.4 for men (Wahlefeld *et al*, 1974; Dharnidharka *et al*, 2002; Rule *et al*, 2004).

The uric acid is comprised from the breakdown of purine nucleotides and consists of carbon, nitrogen, oxygen and hydrogen. The usual uric acid levels are different between male and female, but male is significantly higher than female, as in black person is higher than the white person (Fang and Alderman, 2000). As result, any disease impedes function of Kidney would be raised the level of uric acid in the blood and may accumulate in tissues, and form crystals or stones of kidney (Coe *et al*, 2005; Ngo and Assimos, 2007). Association between the level of creatinine and uric acid with kidney diseases were used as the biomarker to detect and determine the efficiency of kidney function (Meti *et al*, 2015; Levey *et al*, 2006).

The aim of this research was to investigate the efficiency of the kidney after the surgical operation by removal one kidney or partial kidney (nephrectomy), which are recognized by the following :

1. Histopathological changes study of remain right kidney in unilateral nephrectomy and right with left kidneys in partial nephrectomy.
2. The biochemical changes were studied for Kidney function and scaling the level of creatinine and uric acid in serum as biomarker parameters to identify kidney activity.

MATERIALS AND METHODS

Animals

Thirtieth healthy adult, local breed male rabbits (*Oryctoagus cuniculus*), aged 6-12 months, weight (1.25 – 1.5 kg) were used. Rabbits were housed in the animals' field in the Kufa Faculty of Veterinary Medicine, University of Kufa. All rabbits were fed on green grass and concentrate food (pellets). Animals were supervised for the month as the careful period from diseases and treated with antihelminth to avoid any internal and external parasites infestation. Ivermectin at a dose of 0.2 mg/ kg. body weight subcutaneously was used for this purpose. The animals have fasted for 24 hours of food and 12 hours water with held preoperatively. The treated animals were put under observation postoperatively.

Experimental design

The experimental animals were randomly divided into three groups: two equal treated groups (A and B) and group C and (Zero time) as the control group. Group A was removed total left kidney and divided into two groups (A1 and A2), after those animals were killed in respectively after 15 days and 30 days.

In the same way, group B, after conducting the operation and removed partially of the left kidney and treated was divided into two equal subgroups. The first group (B1) killed after 15 days and another group (B2) was killed after 30 days. Blood samples have been collected from control group C and group A and B preoperatively as a zero (time), also at 15, 30 days, to detect and evaluate the blood image and biochemical analysis.

Biopsy of kidneys (partial and right kidney) was collected from each subgroup at 15, 30 days postoperatively for histopathological examination. However, adrenal glands, blood supply, capsule and

nerves of left kidney was kept and avoided during operation and partially removed (group A).

Surgical operation

Operations were performed under general anesthesia by injected intramuscularly ketamine hydrochloride at a dose of 40 mg/kg body weight andxylazine hydrochloride at a dose of 20 mg/kg body weight. The operation has conducted by made an incision 4-5 cm at the midline of the abdomen, from the xyphoid cartilage of thoracic cage and extended into posterior of the umbilical area (Fig. 1).

In group (A) : Nephrectomy of the left kidney was performed by blunt dissection of the peritoneum on the helium area of the kidney to identify the renal artery, renal vein and ureter. Then all were separated and each one was legated twice by polygonation 910 (3.0) and cut between two legations carefully to avoid any bleeding or contamination**.** Then the abdominal wall layers were sutured routinely and animal was treated penicillin and streptomycin to protect animals from any complications and inflammations (Fig. 1 A).

In group (B) : Partial nephrectomy of left kidney was conducted by made longitudinal incision on capsule of the posterior part of kidney. Capsule of kidney dissected and separated from parenchyma, which were removed part of it. Then, the stroma of kidney was covered by capsule through the application of adequate simple continuous suture by using for thread polygalactin 910 (size 3.0). After that, interrupted sutures are generally used for capsule using same thread above. (Fig. 1B). The kidney was retracted into the normal position at renal fossa of the back of the rabbit.

Post-operative care and prognosis

Animals were housed in clean and excellent environment for recovery. Animals were fed with good and concentrated food (pellets and green). All groups were supervised to be sure no any complications or health problem. As prevention, animals were injected intramuscular antibiotic included: penicillin and streptomycin in a dose of 20000 I.U. and 20 mg/kg B.W. respectively, which were continued for four days post-operation. In addition, rectal temperature, respiratory and heart rate monitored daily for five days post operatively.

Biochemical examination of serum

The blood sample was directly collected from the heart in the sterilized tube. About 5ml of blood from each animal, blood samples were left at room temperature for few minutes to lyse and extract blood serum. Then, samples were centrifuged at 706xg, 15minutes and 4^0C (centrifuge, K-Gemmy Industrial Crop, made in Taiwan). As plain tubes were used for preparing sera for subsequent biochemical tests (Bishop *et al*, 2000). Each sample was labelled and given a serial number together with the group name. The serum samples were stored until used (Falanga, 2005).

Serum samples of control and groups were analyzed by using diagnostic kits and spectrophotometers.

1. Determination of Serum creatinine concentration

Specific creatinine kit (Mod Jaffe Kinetic Method) was used to measure the level of creatinine in serum by using Colorimetric method Jaffe without deproteinization. Serum of different groups was incubated with the kit and following instructions of kit. Particularly, creatinine is interacted at the alkaline environment and lead to change in color and intensity according to concentrations of creatinine in each sample. Then, the spectrophotometer was used for reading creatinine level in all samples and analysis.

2. Determination of Serum uric acid concentration

Level of uric acid in all groups was scaled by using uric acid (Uricase/ PAP) kit. The Colorimetric enzymatic method Uricase –POD-PAP was used, the analysis of data. In this kit, uric acid is converted by uricase and H2O2 which, under the catalytic influence of peroxide (POD), oxidizes compound, reacts with 4-aminophenazone and 3,5-diclorophenol–sulphonate and produced a red colored compound. The intensity of red color in sample evidence increase level of uric acid concentration in the sample and increase absorbance of color in the spectrometer.

Histopathological study

Biopsy kidneys from A, B and C group were collected after killing rabbits at different times 15 and 30 days as the following. Group A collected from right kidney only because of no left kidney. Group B, biopsy of partial left kidney and total right kidney were collected, and group C both right and left kidney were collected. All biopsy were preserved in 10% neutral formalin Buffer solution till fixation and after that, all samples were prepared for the histological section and stained hematoxylin and eosin (Luna, 1968).

Statistical analysis

All biochemical data were analysed as means± standard error (M±SE), in addition, one-way analysis of variance (ANOVA). SPSS version was applied to analyses data. The comparison among groups was done by using Duncan test. Possibility (P<0.05) was considered as statistical significance.

RESULTS AND DISCUSSION

The anatomical results revealed that control and total

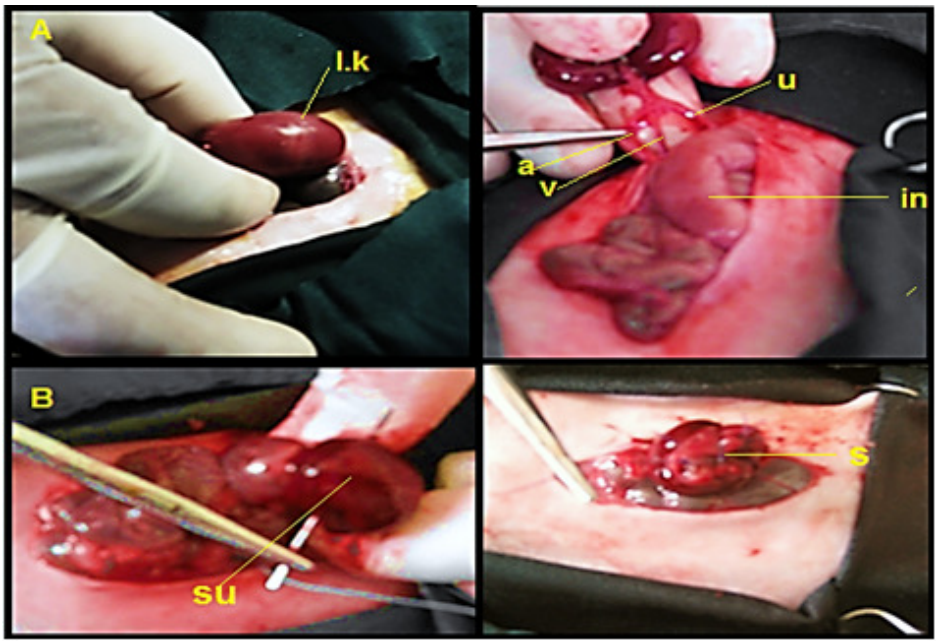

Fig. 1 : These images illustrated group (A). Exteriorized of the kidney from abdominal cavity: l. k.-the left kidney, u- ureter, v- renal vein, a- renal artery. In – intestine. Group (B). excised part of kidney, on the subtotal nephrectomy. Su- subtotal nephrectomy. S-stroma.

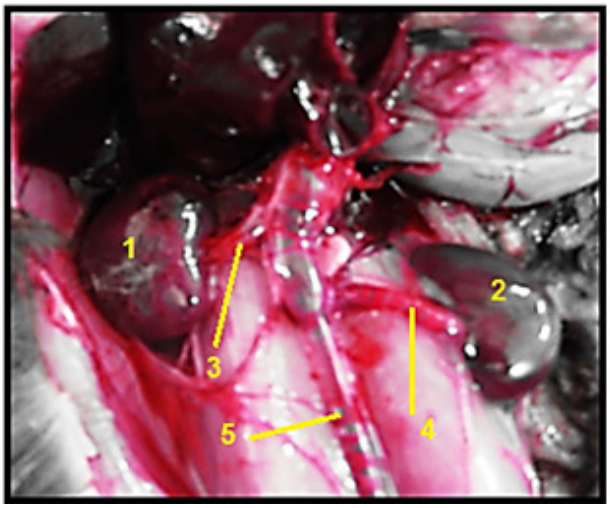

Fig. 2 : This image showed the normal position of two kidneys rabbits (control group). 1-The right kidney cranially than the left kidney. 2-The left kidney. 3-right renal artery. 4-left renal artery. 5-the abdominal aorta.

right kidneys have grossly appeared as bean-shape, similar of most kidney mammals and humans, both kidneys have concave and convex surfaces, in the concave surface lies the hilum which that connected with the renal artery, renal vein and ureter (Fig. 2). These results exactly showed by Al-Kahtani *et al* (2004). The renal hilum located in concave surface or medial surface of kidney and enter via it renal artery, renal vein and in contrast, the ureter would be left it.

Both kidneys show lies in the sub-lumbar region, the anterior border of the right kidney touched the liver and caudally made the renal impression. These findings were in agreement with Gadjev (1995), Adams (1987) also, right kidney lay and extended between the 10 and 11 ribs space at first lumbar vertebra (Fig. 2).

Left and right kidney are normally positioned in lumbar region of the body, but the left kidney located less distance at level of the median plane of the body compared to the right kidney and adjacent the intestine, this result notified by Gadjev (1995).

Moreover, the left kidney presented between the 2nd and the 4th lumbar vertebrae, and ventrally bordered on jejunal loops and ventrocranially in relation with descending colon and the body of the pancreas. The aorta, artery renalissinistra and vein renalissinistra were medially positioned to both kidneys.

The blood supply of kidneys is the left and right renal artery, originated from abdominal aorta. Nevertheless, the right artery was shorter than the left artery because the left kidney was away from the median plane than the right kidney (Fig. 2). Same this anatomical result was assured by Kent (1987) each kidney is supplied usually by a single artery, arising from the abdominal aorta. The right renal vein is also shorter than the left renal artery and directly enters the inferior vena cava. The left renal vein receives blood from the left gonadal and adrenolumbar veins before draining into inferior vena cava.

Gross study of kidneys after post operation (post mortem)

The anatomical results of kidneys after post operation

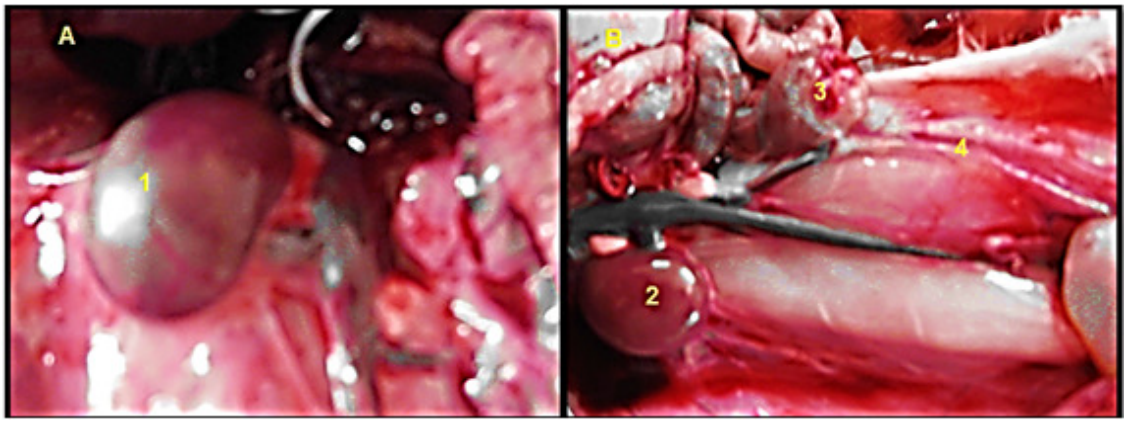

Fig. 3 : These images showed the kidney of rabbit post operation. A-1-Hypertrophy of the right kidney post operation in unilateral nephrectomy. B-2-Hypertrophy of right kidney. 3- The left kidney. 4-Filled the left ureter with urine which indicated to the action of partial left kidney post-operation in group (B).

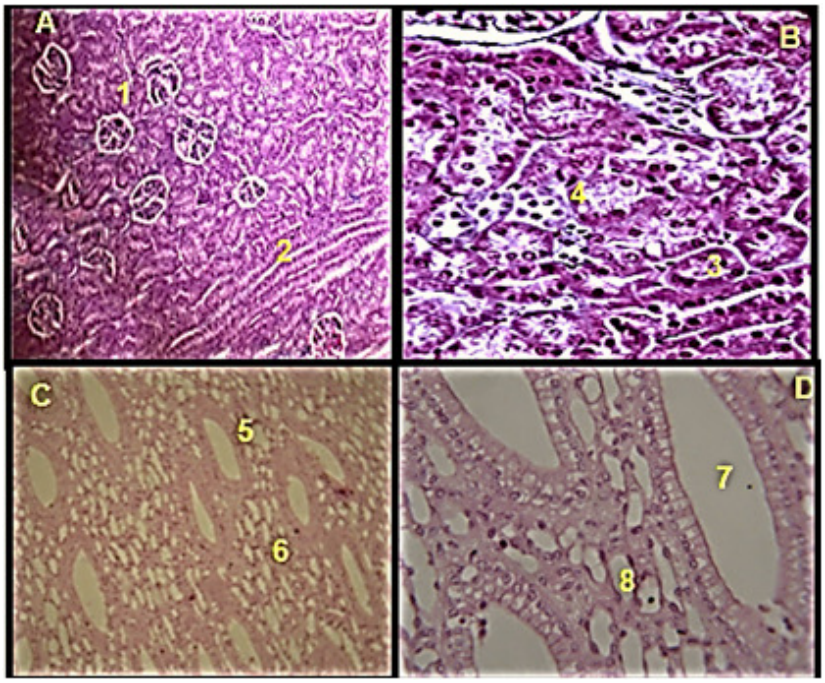

Fig. 4 : These images displayed the tissue section of control kidney of the rabbit: A-1- Cortex region (glomerular). 2- Collecting duct (H & E, X100). B- Cortex region. 3- Proximal convoluted tubule 4- distal convoluted tables (H & E, X400).C- Medulla region. 5- The thick segment of Henle's loop. 6- the thin segment of Henle's loop. (H & E, X100). D- Medulla region. 7- The thick segment of Henle's loop. 8- The thin segment of Henle's loop (H & E, X400).

have been showed hypertrophy occur in right kidney in groups (A and B) and in the left kidney in group (B) at 30 days (Fig. 3). These results were agreed with (Meyer, 1991), that kidneys were suffered hypertrophy and whole set of changes in the structure and function of the kidney that follows the reduction of its mass.

Also, the right and left kidney in the group (B) revealed that two ureters filled with urine, which consider as indicated of the action activity of kidneys in the group (B) (Fig. 3). These result in agreement with the findings of Galla *et al* (1974), Seyer Hansen *et al* (1985), that following removal of one kidney, the remaining another kidney would be undergone a rapid and marked increase in both size and function.

Although, earlier studies have suggested that this adaptive response is age dependent, and there is no evidence to show that the change in renal function is greater in young immature animals than adults animals (Douglas-Denton *et al*, 2002; Lane *et al*, 2008) and partial nephrectomy is better than radical nephrectomy to preserve renal parenchyma and function.

Histological results

Current study was displayed that cortex of kidney

contains glomerulus with proximal and distal convoluted tubules, which are usually lined by a simple cuboidal epithelium, and proximal, collecting tubules have brush border in (Fig. 4A.B), while the medulla region contains thick and thin segment of Henle's loop (Fig.4 C.D.). These results were absolutely agreement with Eurell and Frappier (2013), each kidney is composed of functional filtering unit called nephron.

Each nephron consists of a dilated portion. The renal corpuscle, proximal convoluted tubules are thick and lined by low the simple cuboidal epithelium, whereas a thin segment is lined by simple squamous epithelium of Henle's loop and distal convoluted tubules. In addition, collecting duct has same histology structure despite, it has different embryologic origin from the nephron and represented the excretory duct of the system. Another study was identified proximal convoluted tubule, which is lined by a simple cuboidal epithelium.

The apical end of each cell has a brush border of microvilli (Junqueira and Carneiro, 2005). This provides an increased surface area to accommodate the membrane channels that are responsible for absorbing into the cell small molecules from the filtrate in the tubular lumen. The brush border is seldom plainly visible in routine histological preparations, but proximal tubule cells tend to have indistinct apical ends (in contrast to the more definite apical border of cells comprising distal tubules and collecting ducts) (Al-Kahtani *et al*, 2004).

The loop of Henle's consists of a descending limb, having an initial short thick segment followed by a long thin segment and an ascending limb, having a thin segment followed by a thick. Taking together, histological and anatomical study with other researches studies made diagnosis and recognition easily to detect any disorder or changes in the tissue of kidneys after partial or unilateral nephrectomy after the operation to identify any unusual lesions.

Histopathological finding

Tissue sections have been collected from the control group (C) (left and right kidney) and unilateral right kidney and partial left kidney nephrectomy after 15 days and 30 days and histologically prepared to study.

Fifteen days post operation (group A)

After removing the left kidney, single the right kidney was under pressure and high filtration activity of blood. The section of group (A) showed there are fibrous thickening of capsular area with large dilation of cortical renal tubules and vacuolation of glomerular tuft (Fig. 5.A). In addition, walls of interstitial blood vessels were much thick (Fig. 5B).

These results were noticed by Alison *et al* (2002), Smadel and Farr (1939), this evidence that proliferation of vascular (capillary) endothelial cells, myofibroblasts in fibrous tissue and the regeneration of specialized cells within a tissue are happed due to response of the tissue to damage. Consequently, increase vascular endothelial cells and myofibroblasts hyperplasia in histological section evidence to repair and regenerations process in kidneys were activated to replace deficiency of parenchyma of partial kidney and nephrectomy of the left kidney.

Furthermore, other sections of renal tubules showed there are swelling of vacuolar degenerative changes of the epithelial lining cells with atrophy of glomerular tuft and dilation of Bowman's space (Fig. 5C). Additionally, other sections showed it is clear and a mild fibrosis of the cortical interstitial tissue with infiltration of mononuclear cells, the fibrous connective tissue lead to thickening of Bowman's capsule (Fig.5 D&E). Other studies are concluded that reduction in renal mass alone may damage the glomeruli, or possibly because of increased tension in the glomerular capillary walls causing by increasing pressure within the capillaries and to an increase in the radius of the capillaries resulting with compensatory hypertrophy (Kawaida *et al*, 1994; Brenner, 1985; Klahr *et al*, 1986).

The histological study of the medullary region of kidneys displayed increasing dilation of collecting renal tubules which are containing eosinophilic hyaline in their lumen as well as lesions of hypertrophy and hyperplasia (Fig. 5F). Specific chemistry stain for sections showed and cleared the interstitial fibrosis around the medullary tubules. Many researchers are proofed injured and removed part of kidneys would be led to growing compensatory tissue of the kidney following by hypertrophy and hyperplasia and changes in structure and function of the kidney (da Silva *et al*, 2017). On other hands, other researchers suggested that hyperplasia is induced by the renal injury, whereas the hypertrophy is associated with the increased demand for work capacity and overactivity of kidneys (Megyesi *et al*, 1999) as same changes are recorded in this study. Besides, the compensatory hypertrophy of kidney was described as a whole set of changes in the structure and function of the kidney that follows the reduction of its mass (Meyer, 1991). Recent studies of humans and animals after nephrectomy have been demonstrated increasing tissue mass after some types of cell loss is achieved not only by proliferation of the remaining cells but also by the development of new cell from stem cell because the mechanisms of hyperplasia occur after partial

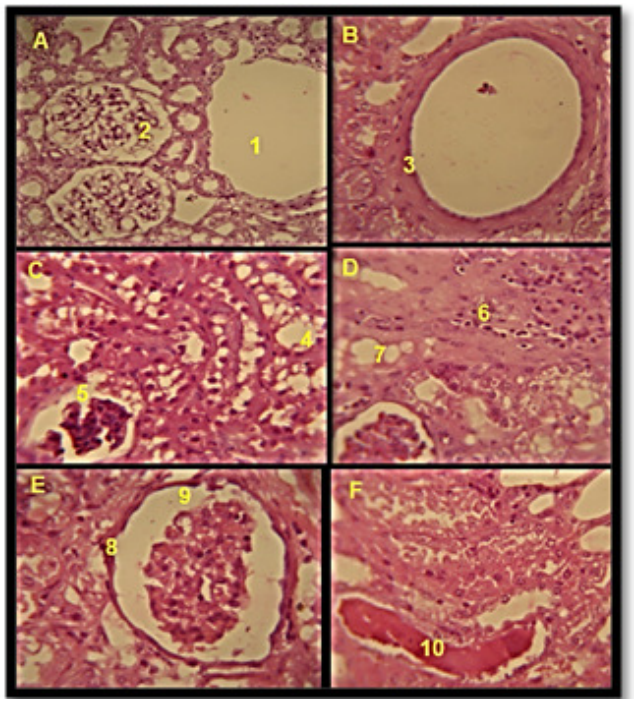

Fig. 5 : This image showed the tissue section of kidney of the rabbit, (group A), 15 days post operation showing: A-1-Cystic dilation of cortical renal tubules 2- vacuolationof glomerular tuft (H & E, X400). B- 3-Fibrous thickening in the walls interstitial blood vessel (H & E, X400). C-4-Swelling vacuolar degenerative change of cortical renal tubules 5- atrophy ofglomerular tuft (H & E X400). D-6-Fibrosis of cortex and mononuclear cells infiltration 7-Vacuolar degeneration of cortical renal tubules (H & E X400). E-8- fibrous thickening of Bowman's capsule 9-atrophy of glomerular tuft (H & E X400). F- 10- cystic dilation of medullary tubules containing hyaline cast in their lumina (H & E X 400).

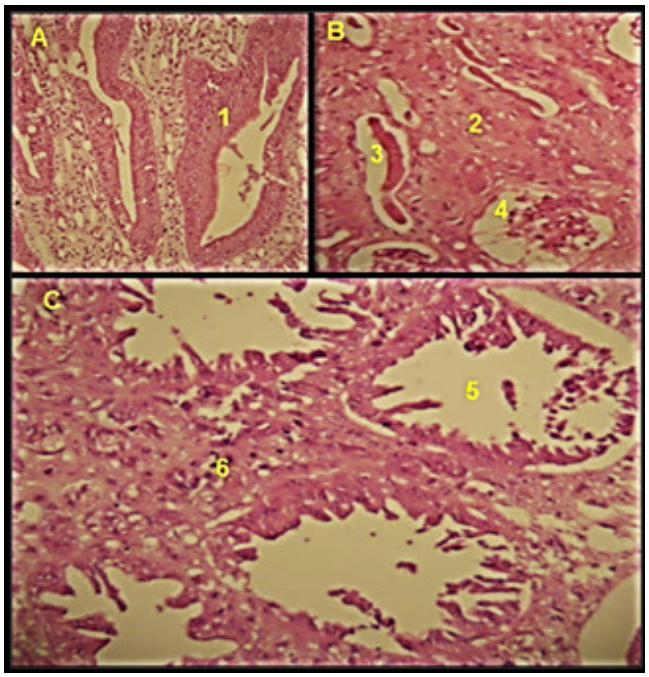

Fig. 6 : This image displayed: A-tissue section of kidney of rabbit, group (A), 30 days post operation showing: B-Hyperplasia of epithelial cells lining the collecting tubules leading to narrowing of their lumina (H & E X100). C-Tissue section of the right kidney of rabbit, group (B), 15 days post operation showing:1-Extensive fibrosis of cortex. 2-Interstitial connective tissue. 3- Cystic dilation of cortical renal tubules containing hyaline cast. 4- Atrophy of glomerular tuft (H & E X100).5-Interstitial medullary fibrosis 6- hyperplasia of the epithelial lining of collecting tubules forming papillary projections (H & E X400).

nephrectomy, this lead to prompt proliferation of residual cells of kidney finishing with hyperplasia (Sammut *et al*, 2013; Kochová *et al*, 2009).

Thirty days post operation (group A)

In addition to the pathological lesions observed in the previous period. The kidneys showed many changes involved with epithelial lining of proximal and distal convoluted tubules undergoes coagulative necrosis. Also, there is hyperplasia of the epithelial cells lining the collecting tubules more complicated than the previous period and causing narrowing of the luminal tubules (Fig. 6A). In the same way, past studies found that unilateral nephrectomy induces a series of morphological changes in the remaining kidney. These morphological changes called as compensatory hypertrophy and hyperplasia which are associated with numerous functional changes of the remnant kidney (da Silva *et al*, 2017).

Fifteen and thirty days post operation (group B)

In this section, removing partially, the left kidney, the total right kidney is active. The histopathological changes of the right kidney after 15 days are very clear and detectable compared to the control but less than recorded in group A after the operation. However, the main changes of left kidney were identified fibrosis of the capsular region and the cortex leading to enlargement and dilation of cortical renal tubules which are containing the hyaline and dilation of Bowman's capsule (Fig. 6B). Other section of the medullary of the left kidney displayed fibrosis of interstitial medullary with hyperplasia of epithelial lining the collecting tubules which form the papillary projection (Fig. 6C). These results agreed with other previous studies (Sidorova and Gorbunova, 1976) which were distinguished that the response of the kidney after injured and destruction of tubules are limited to be compensatory hypertrophy of remaining nephrons. Hence, the remaining tubules of damaged kidneys would be large and more dilated (Tobar *et al*, 2013). After 30 days of operation, same histopathological changes were noticed but it was more developed and complexity. However, after removing part of the left kidney, right kidney was less impaction compared to right kidney in group A.

Table 1 : Effect of Unilateral serum uric acid and creatinine mg/dl levels postoperation for 15, 30 days of group A.

Day	Uric acid (mg/dl)	Creatinine (mg/dl)
Zero time	1.01	1.4
Day 15	1.70	1.1
Day 30	2.90	1.3

The different capital letters denote significant differences between groups (P<0.05).

Table 2 : Effect of partial nephrectomy on serum uric acid and creatinine mg/dl levels postoperation for 15, 30 days of group B.

Day	Uric acid (mg/dl)	Creatinine (mg/dl)
Zero time	0.80	1.29
Day 15	1.9	1.9
Day 30	3.5	2.1

The different capital letters denote significant differences between groups (P<0.05).

Biochemical examination

Biochemical techniques applied to the body's tissues and fluid in health and disease, the serum enzyme assays are used to assess the integrity and vitality of various tissues (Underwood and Cross, 2009). In this study, the kidney function, single right kidney estimated after nephrectomy of left kidney in the group (A) and the group (B) partial left kidney post operation also has been tested. Two parameters were used to assess the activity of kidneys, by measuring the level of uric acid and creatinine.

The results of (Tables 1 and 2) have demonstrated the effect of the unilateral right kidney in the group (A) and partial left kidney in the group (B) by scaling the level of uric acid in urine and creatinine serum in blood. The results of serum and uric acid for all groups: the group (A) and (B) at two different durations were the significant increase at (P<0.05) compared to zero time. The values of serum creatinine of group at 15 days (A) showed are significant increase P<0.05 in comparison with zero time, while the values of serum creatinine for group (A) at 30 days had no significant, compared to zero time. As well, the values of serum creatinine for group (B) at two durations were significant increase in comparison with zero time. However, it was no significant between- group (B) at 15 and 30 days. These results were corresponding with other studies, which were reported that urea accumulated in blood, lead to increase the level of the uric acid and creatinine during nephritis diseases and also after nephrectomy of rats (Fong *et al*, 2014; Sasamura *et al*, 2005).

Like, other researchers reported that the mean serum creatinine had been increased from 1.03mg/dl preoperatively to 1.26 mg/dl postoperatively at (p<0.05). The mean of the level of creatinine in blood serum had significantly increased at 3 months after 12 months post-surgery (Antoniewicz *et al*, 2012). Additionally, post-operation, the concentration of creatinine after 16 months was still increased compared to the pre-operation (zero time), but there was no statistical significance at (p<0.05). The concentrations of creatinine and urea in blood were immediately increased after subtotal nephrectomy, followed by the restoration of biochemical parameters during next two weeks and three months (Gava *et al*, 2012; Jacobi *et al*, 2006).

In conclusions, unilateral kidney would be located under pressure after nephrectomy, it is led to change in lining of tubules of glomerulus and effect on efficiency of kidney filtration process, as well as the partial kidney might be reduced the stress on another kidney in case removed part of parenchyma of kidney during nephritis and tumors diseases.

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