Effect of potassium Iodide on Kidney in Albino Mice (*Mus musculus)* and their Pups

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Abstract
The present study was designed to examine the effect of potassium iodide for its efficacy to induce morphological malformations and histopathological lesions of kidney of adult male mice, pregnant mice and pups of *Mus musculus* .
The results of the present study showed statistically a non-significant effect of kidney weight in the rapeutic, hyper & hypo dose groups compared with control group, while statistically showed significant ($p \leq 0.01$) decrease in kidney weight of hyper, hypo dose groups in pregnant mice.The histological examination showed many lesions in the kidney of adult male mice, pregnant mice and pups . The results showed as infiltration of lymphocytes, degeneration, necrosis, atrophy and hemorrhage .

Introduction
Potassium iodide is a salt, similar to sodium chloride (NaCl), normal table salt. Its chemical symbol is KI, representing a compound of potassium (K) and iodine (I) [1] . Its readily absorbed in the intestinal tract and distributes rapidly through the extracellular space [2] .When potassium iodide is introduced simultaneously at a short interval after each other , into the stomach Iodide is absorbed in the digestive tract [3] . Potassium travels to intestines, the intestine absorbs potassium into blood stream , where it circulates until it reaches the kidneys[4]. Overdose of potassium iodide causes acute renal failure secondary to tubular necrosis, laryngeal edema, systemic granulomatous vasculitis, and causes hemolytic anemia [5] .

Materials and Methods
1- The animals
One hundred albino mice *Mus.musculus* were used in this study . They were purchased from the center of Infertility and Embryology Research, Baghdad, Iraq .
Mice were kept in the animal house in wire-meshed stainless steel cages (i.e. two animals in one cage), but the cages were arranged in a manner that one animal could see at least several others. The environment in the animal house was controlled in which the temperature was maintained at (20-24C°) , light program of 12:12 hours light: dark cycle with good ventilation .

2. The drug used
The drug used in the experiment was pure powder of potassium iodide . It was kept in a cool, dry place, away from direct heat and light . The experimental animals were administered potassium iodide gives by oral three doses time/ day. Therapeutic , hypo and hyper doses using cavage as follows :
1. 0.04 mg/0.025 kg/day in a single daily dose (therapeutic dose) .
2. 0.08mg/0.025 kg/day in a single daily dose (hyper dose) .
3. 0.02mg/0.025kg/day in a single daily dose (hypo dose) [6] .

3. Animal grouping
The mice were used in this experiment aged 3 months, and their average body weight was 25±2 gram at the beginning of the experiment .
They were divided into three main groups as follows :

Adult males
Consisted of 20 animals divided into four subgroups each of 5 animals :
A-Control males received only normal diet and water.
B-Male mice were administered potassium iodide in an oral dose of 0.02mg/0.025 kg /day in a single daily dose for four weeks (hypo dose) .
C-Male mice were administered potassium iodide in an oral dose of 0.04mg/0.025 kg /day in a single daily dose for four weeks (therapeutic dose) .
D-Male mice were administered potassium iodide in an oral dose of 0.08mg/0.025 kg /day in a single daily dose for four weeks (hyper dose) .

Pregnant mice
Consisted of 20 animals divided into four subgroups each of 5 animals:
A-Control mothers received only normal diet and water .
B-Mothers were administered potassium iodide in an oral dose of 0.04mg/0.025 kg /day in a single daily dose, the treatment was continued from the 7th day of pregnancy to the 21st day of lactation.
C-Mothers were administered potassium iodide in an oral dose of 0.08mg/0.025 kg /day in a single daily dose, the treatment was continued from the 7th day of pregnancy to the 21st day of lactation.
D- Mothers were administered potassium iodide in an oral dose of 0.02mg/0.025 kg /day in a single daily dose, the treatment was continued from the 7th day of pregnancy to the 21st day of lactation .

4- Preparation of tissues
All animals were dissected under chloroform anesthesia. The kidney weight was recorded after dissection for each animal using Sartorious sensitive balance (0.001 mg subdivision), and placed in fixative .

5- Body & Organs weight
The weights of organs were recorded at dissection of the animals. While the body weight for all pups was

recorded before dissection with sensitive balance, the mean body weight and standard deviation were calculated for each group .

6- Histological sections

The tissues were processed according to [7], as follows :

1-Fixation

Immediately after removal and weighing of kidney, and fixed in 10% neutral buffered formalin solution (10ml of 40% formaldehyde + 90ml of tap water), for 18-22 hours at room temperature .

2-Dehydration

The tissues were removed from the formalin (10%) and then washed in running tap water for 30 minutes to remove traces of fixative .

3-Clearing

The purpose of this stage was to remove alcohol from tissue (dealcoholization), this was made using two changes of xylene (30 minutes for each change) .

4-Infiltration and embedding

the tissues were passed through mixture of xylene and molten paraffin wax (melting 56-58C°) for 30 minutes, and then the tissues were kept in melted paraffin wax for one and a half hour for two changes to remove the xylene. Embedding was made in special stainless steel containers (molds), the tissues were removed from the paraffin bathes to the molds and the molds were filled with wax after proper alignment of the tissue and labeling the blocks .

5-Tissue sectioning

rotary microtome (LKB-U.K.) with disposable blades was used. The ribbon was transferred into warm bath 44C°and then to the slides.

6-Tissue attachment

the sections adhesive was needed using Mayer's glycerol-albumin mixture which was lightly smeared over the surface of slides before the attachment of section .

7-De-wax and hydration

de-wax was made using two changes of xylene (15 minutes for each change) and oven, hydration was made by immersing the slide in a descending concentration of alcohol bathes(100%,90%,80%,70% ,50%) , 5 minutes for each bath , then slides were washed in distilled water .

8-Staining

haematoxylin and Eosin staining were used .

9-Mounting

this was made using DPX, cover slips were used to cover the sections .

A light microscope (Motic microscope /China) was used to perform the microscopically investigations of this study .

Results

The results of the present study showed statistically a non-significant decrease of kidney weight in therapeutic, hyper and hypo dose group as compared with the control group. Results were analyzed statistically using Analysis of Variance (ANOVA) test [8] . Table (1) .

Table (1): Means± standard deviation of kidney weight in different groups of adult mice.

Group	Kidney weight(g) Mean± SD
Control	0.25 ± 0.06^{n}
Therapeutic dose (0.04mg)for 30 days	0.25 ± 0.06^{n}
Hyper dose (0.08mg) for 30 days	0.26 ± 0.04^{n}
Hypo dose (0.02mg) for 30 days	0.32 ± 0.08^{n}

^{n} : **non-significant**

1. Morphological changes of kidneys

The results of the present study showed that there is an effect of potassium iodide on morphology of the organs studied . The morphological changes of the kidney in adult male mice showed in therapeutic dose as compared with kidney of the control group (Fig. 1), the kidney was larger than that of normal and more odematus (Fig.2) . In hyper dose it showed the same size but their external appearance became more greenish and mixed with odematus (Fig. 3) . In hypo dose it showed like that of normal in their size but more congested (Fig. 4) .

The morphological changes of kidney in pregnant mice as compared with kidney of the control group (Fig. 5), same appearance in therapeutic (Fig. 6), hyper and hypo (Fig. 7) doses except in hyper dose it became darker or more greenish with presence of fat on the surface of the kidney (Fig. 8) .

2. Histological observations

2.1. Effect of drug on kidney

Control group

The microscopic examination showed the normal structure of kidney and demonstrated the form of glomeruli and convolute tubules (Fig. 9) .

Group A adult male mice administrated therapeutic dose 0.04mg for 30 days

The blood capillaries of glomerulus are destruction that lead to hemorrhage in glomerulus also hemorrhage between the tubules caused by destruction of blood vessels also there is infiltration of lymphocytes , degeneration are present in some epithelial cells that lining the convoluted tubules, also desquamation endothelial cells in some tubules and aggregative in the lumen of tubules (Fig. 10) .

Group B adult male mice administrated hyper dose 0.08mg for 30 days

Most glomerulus of kidney of this group are destruction , damage and the basement membrane of some glomeruli destruction .

Convoluted tubules of kidney destruction in most of sections that prepared from this group and there was hemorrhage between the convoluted tubules and infiltration of lymphocytes .

Also there is desquamation of cells that lining convoluted tubules (Fig. 11) .

Group C adult male mice administrated hypo dose 0.02mg for 30 days

The microscopic examination of cross sections that prepared from kidney of this group showed damage of glomerulus and destruction of basement membrane and there was hemorrhage between the convoluted tubules and destruction in some of tubules and degeneration of lining cells (Fig. 12) .

Group D pregnant mice administrated therapeutic dose 0.04mg

The microscopic examination of cross section that prepared from kidneys of this group showed Damage of glomerulus and destruction of basement membrane that surrounded glomerulus. Some of convoluted tubules are destruction and the lining cells degenerated also there was desquamation of lining cells of convoluted tubules and infiltration of lymphocytes were present in some region in between the tubules and also in the glomerulus (Fig. 13) .

Group E pregnant mice administrated hyper dose 0.08mg

Atrophy of glomerulus are present in some region and in other region there was damage of glomerulus, also the basement membrane destruction in some regions, the convoluted tubules are destruction in most cortex region of kidney and degeneration of the lining cells also there was hemorrhage between tubules that caused by damage in blood vessels (Fig. 14) .

Group F pregnant mice administrated hypo dose 0.02mg

There is damage glomerulus in some regions and damage of basement membrane that surrounded the glomerulus .The destruction of convoluted tubules are present and associated with degeneration of lining cells and desquamation of epithelial cells , also there was infiltration of lymphocytes between convoluted tubules (Fig. 15) .

Group G Control pups

The microscopic examination showed the development of the glomerulus which appear small in size and normal , also the formation of convoluted tubules appear how to develop and some convoluted tubules are complete its development and in some region apparent metaphors (Fig. 16) .

Group H pups mice administrated therapeutic dose

The microscopic examination showed normal forms and development of glomerulus, also the basement membrane appear normal . Convoluted tubules present in some regions intact and normal but in many regions appear with loss its form and there is degeneration and destruction of the cells that form and lining convoluted tubules (Fig. 17) .

Group I pups mice administrated hyper dose

The glomerulus are present intact with normal structure and development even the basement membrane appear normally. While the convoluted tubules are destruction and loss it´s form in some regions and there is degeneration changes in the lining cells of tubules, but also in other regions convoluted tubules appear normal (Fig. 18) .

Group G pups mice administrated hypo dose

When compared the sections that prepared from this group with sections of control group showed no different where the glomerulus present normal in its form and development, also the basement membrane which surrounded glomerulus appear normal in all sections convoluted tubules appear in many sections normal in the shapes and structures, so kidney of this group didn´t affected by this dose (Fig. 19) .

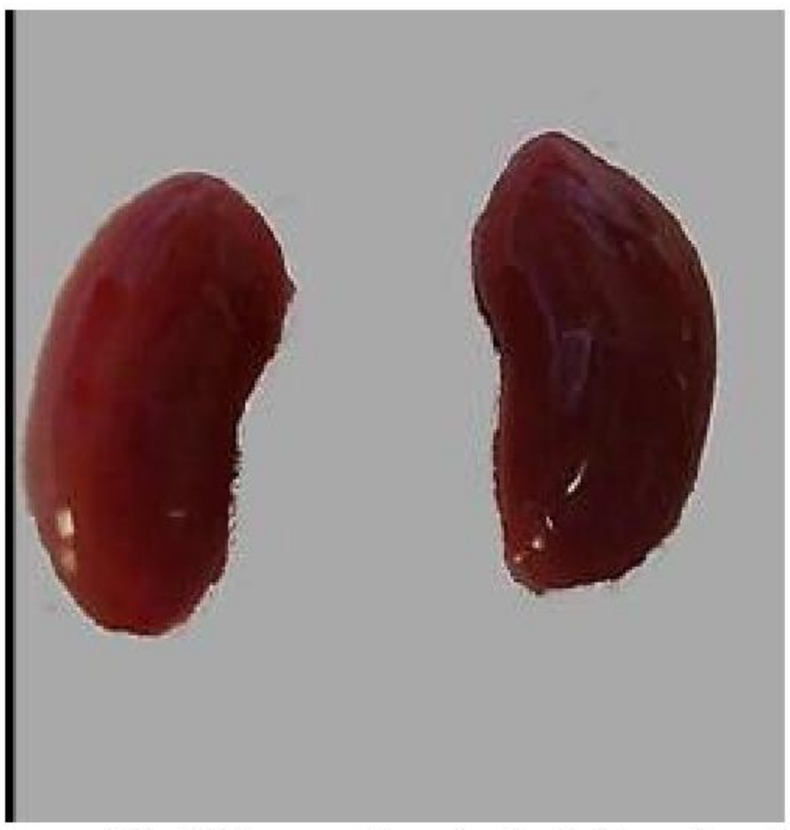

Figure (1): Kidneys of control adult male mice

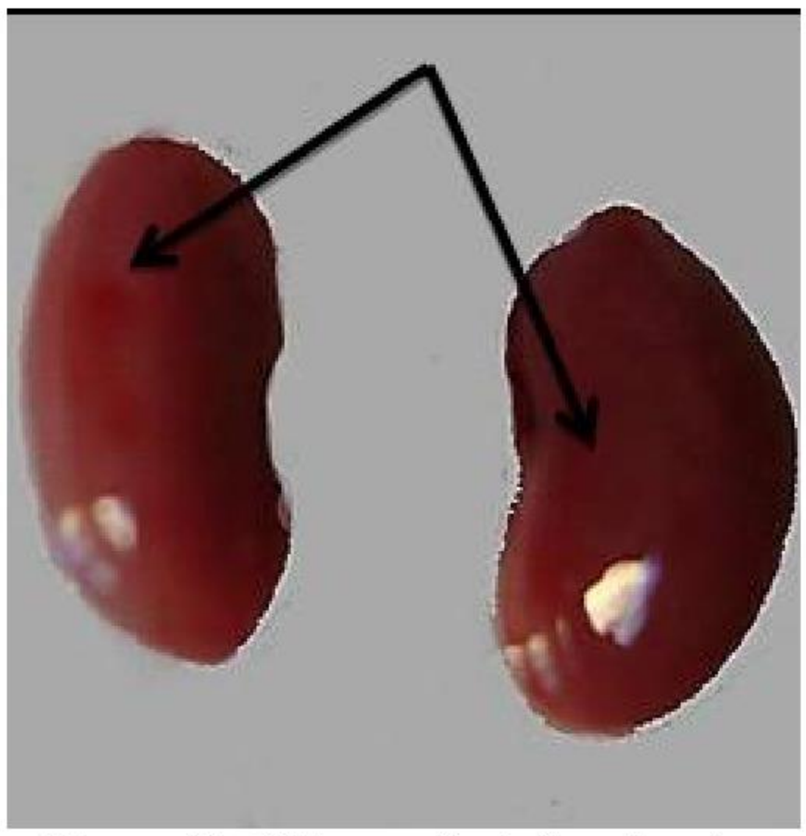

Figure (2): Kidneys of adult male mice administrated therapeutic dose for 30 days demonstrated more odematus

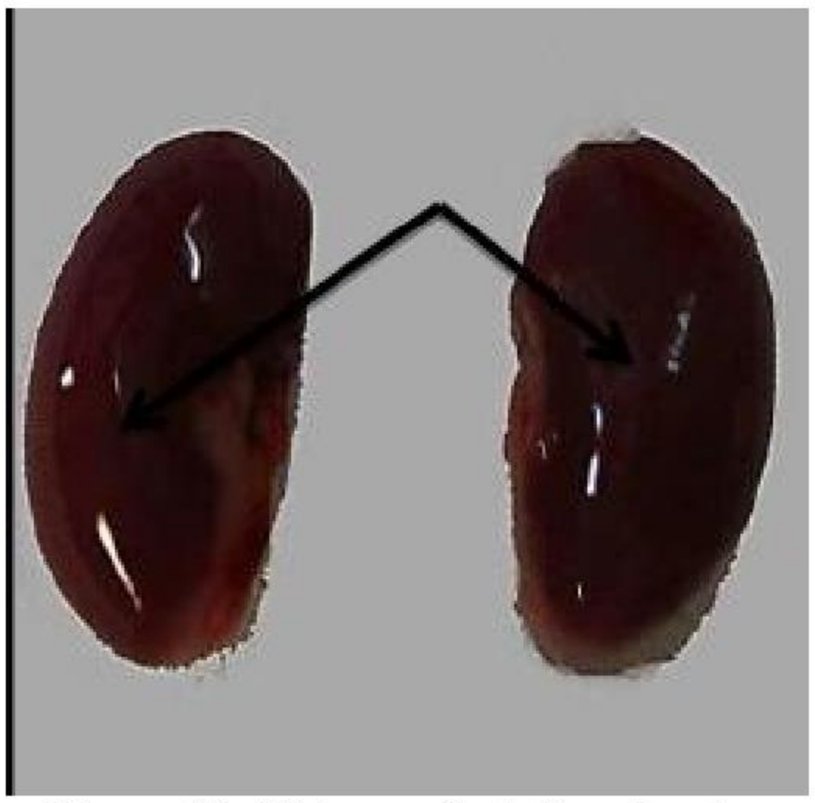

Figure (3): Kidneys of adult male mice administrated hyper dose for 30 days demonstrated greenish mixed with odematus

Figure (4): Kidneys of adult male mice administrated hypo dose for 30 days demonstrated more congested

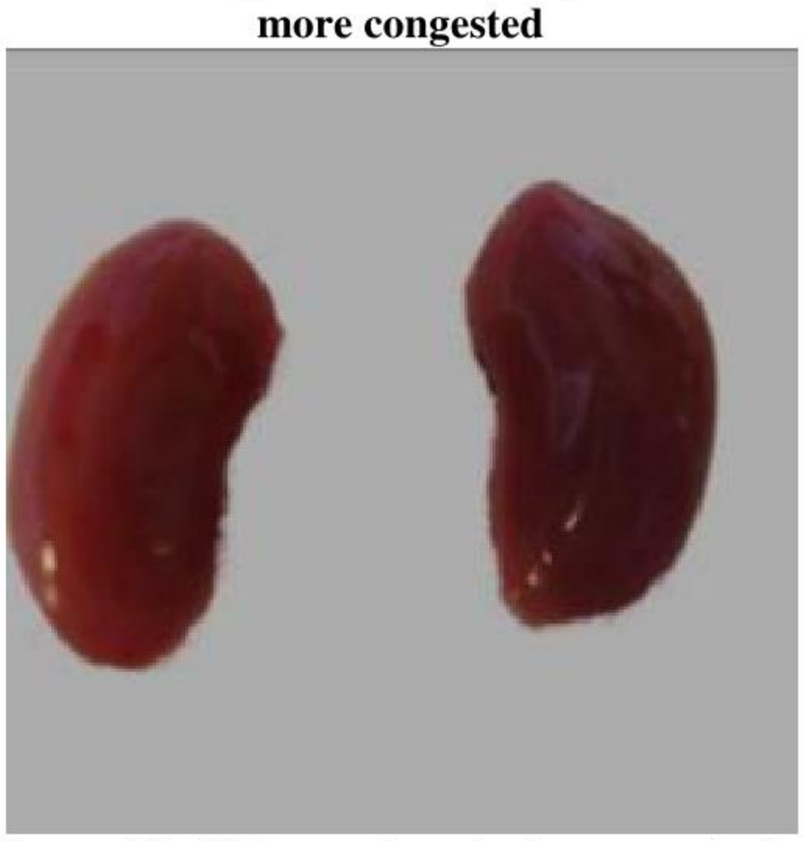

Figure (5): Kidneys of control pregnant mice

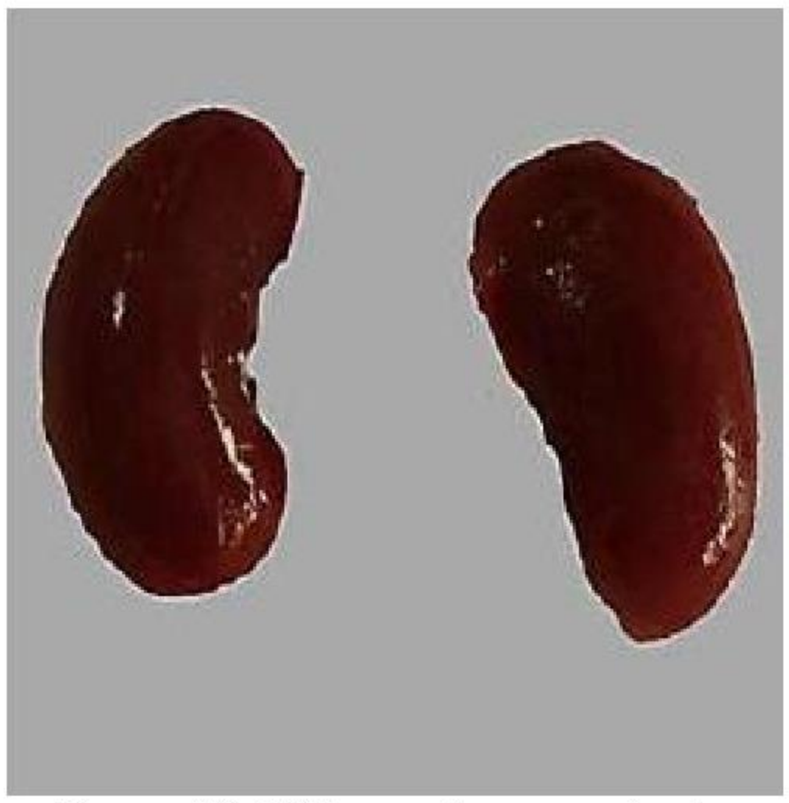

Figure (6): Kidneys of pregnant mice administrated therapeutic dose demonstrated little dark in color compared with hyper dose

Figure (7): Kidneys of pregnant mice administrated hyper dose demonstrated darker and more greenish

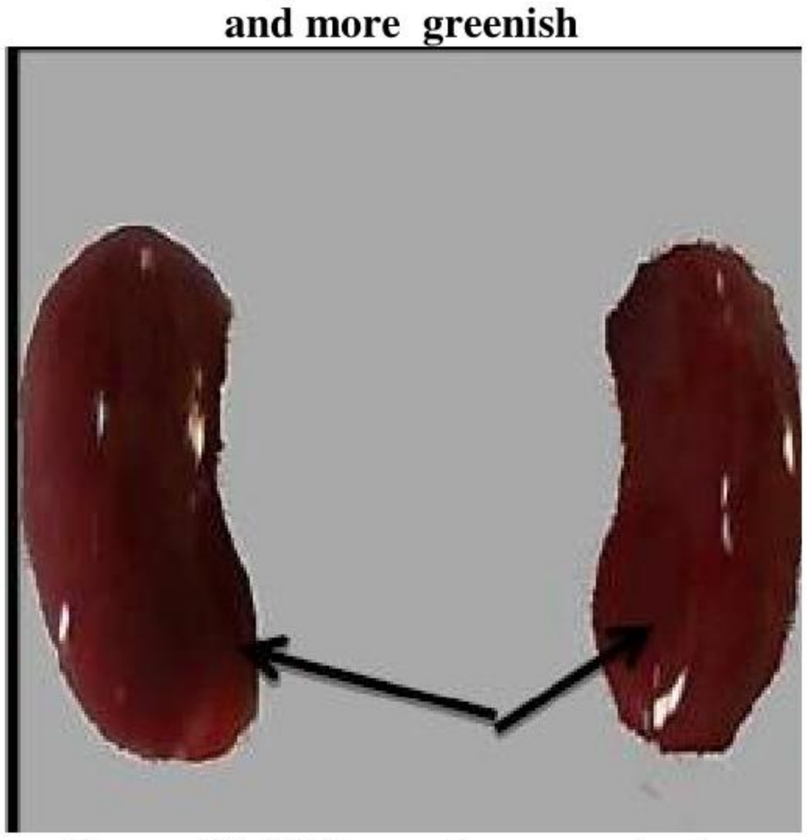

Figure (8): Kidneys of pregnant mice administrated hypo dose demonstrated fat on the surface of kidney

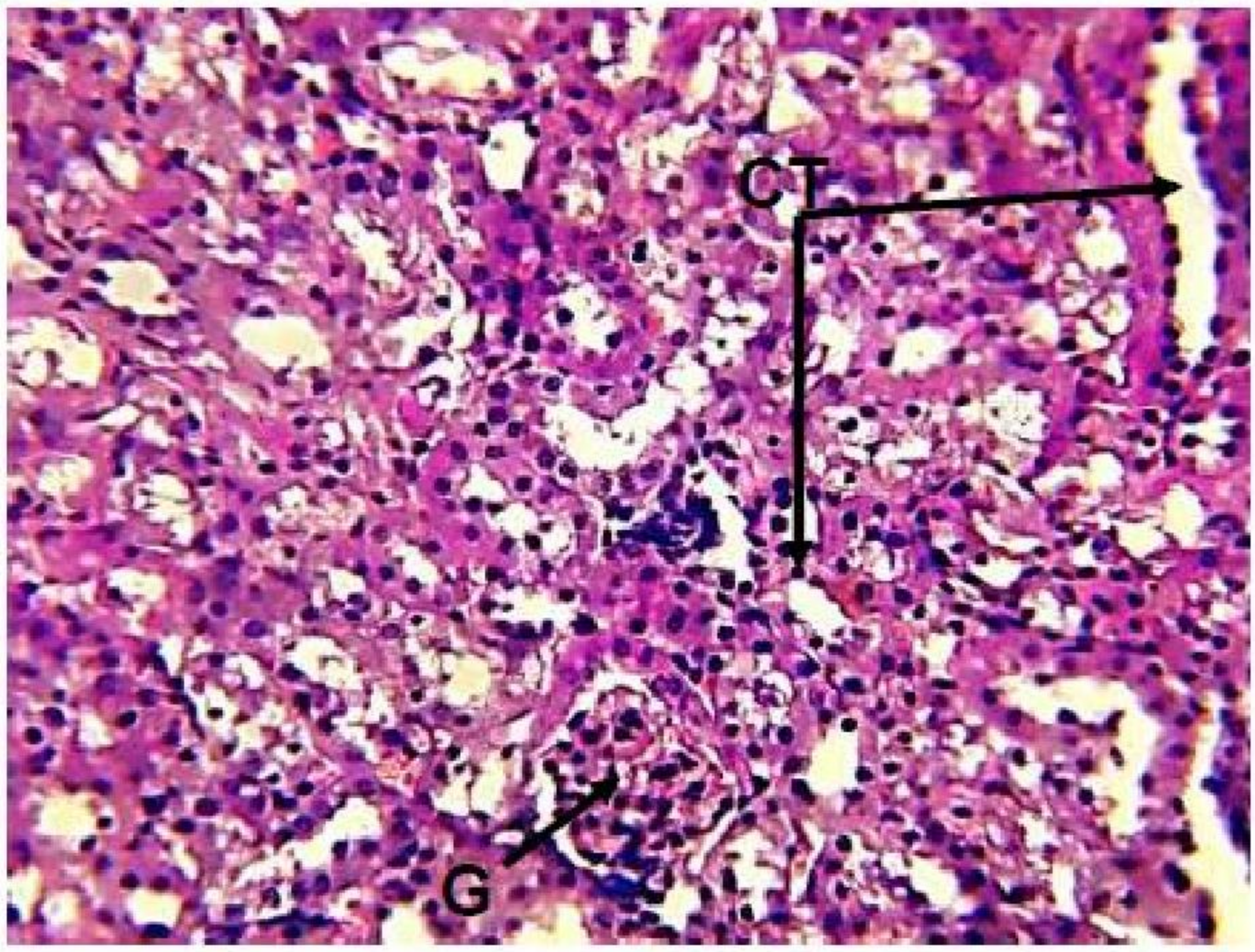

Figure (9): Kidney of control group showed Glomerulus (G) and Convoluted Tubules (CT) (H&E 400X)

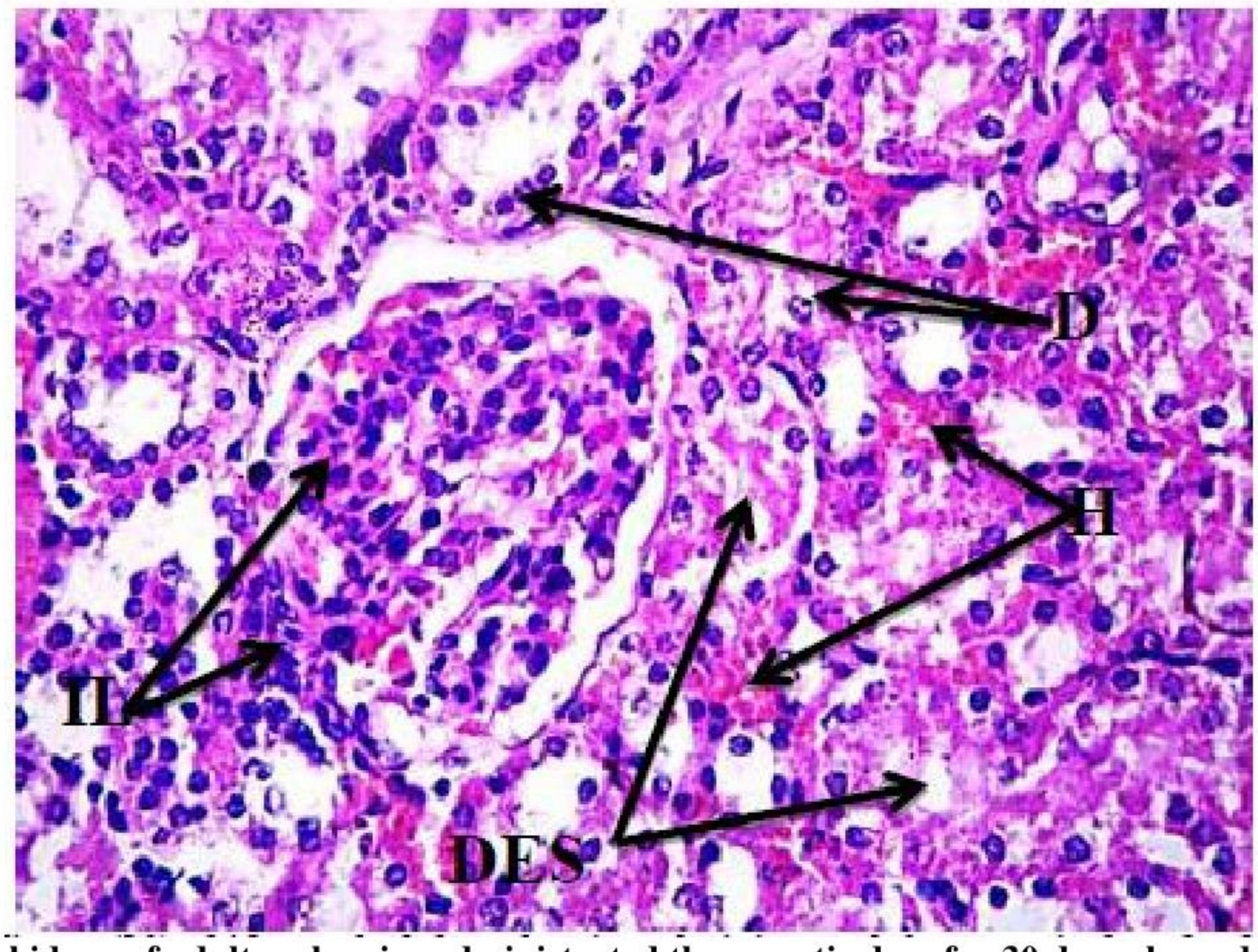

Figure (10): kidney of adult male mice administrated therapeutic dose for 30 days showed Hemorrhage (H), Desquamation of epithelium cell (DES), Infiltration of Lymphocytes and Degeneration (D) (H&E 400)

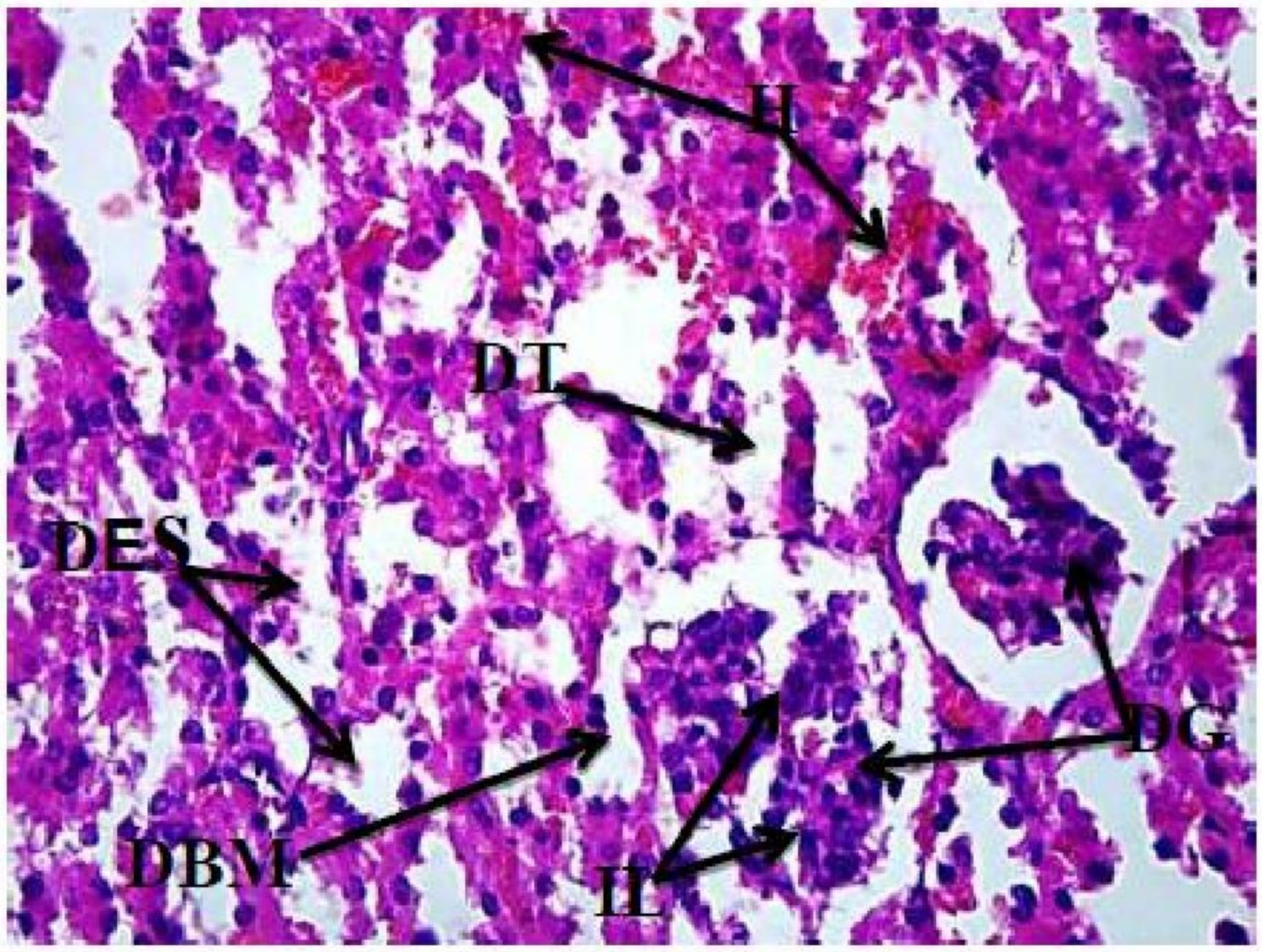

Figure (11): Kidney of adult male mice administrated hyper dose for 30 days showed Hemorrhage (H), Infiltration Lymphocyte (IL), Destruction of tubules (DT), Desquamation of epithelium cells (DES), Damage of Glomerulus (DG) and (DBM) (H&E 400X

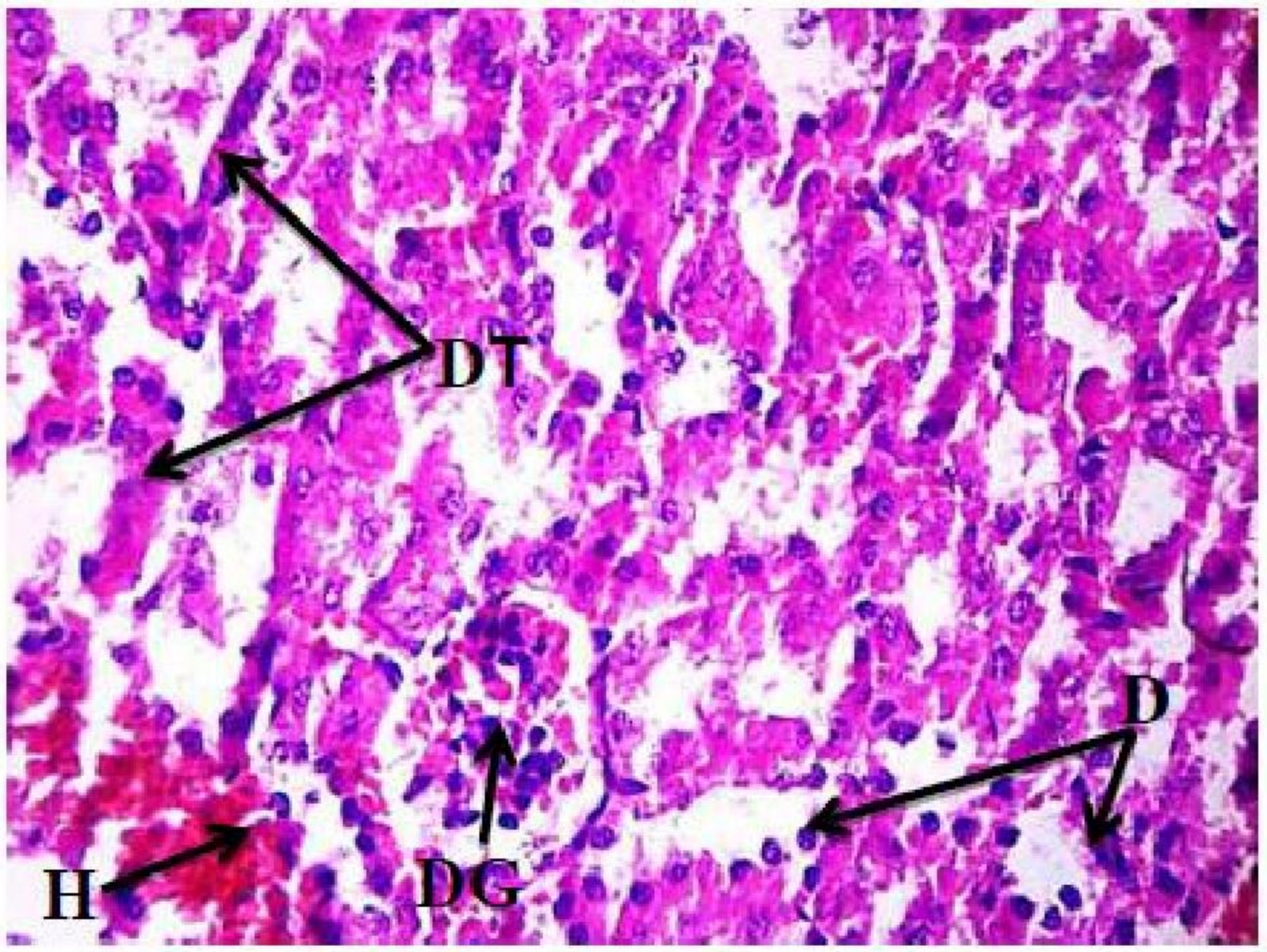

Figure (12): Kidney of adult male mice administrated hypo dose for 30 days showed Destruction of Tubules (DT), Damage of Glomerulus (DG), Hemorrhage (H) and Degeneration (D) (H&E 400X)

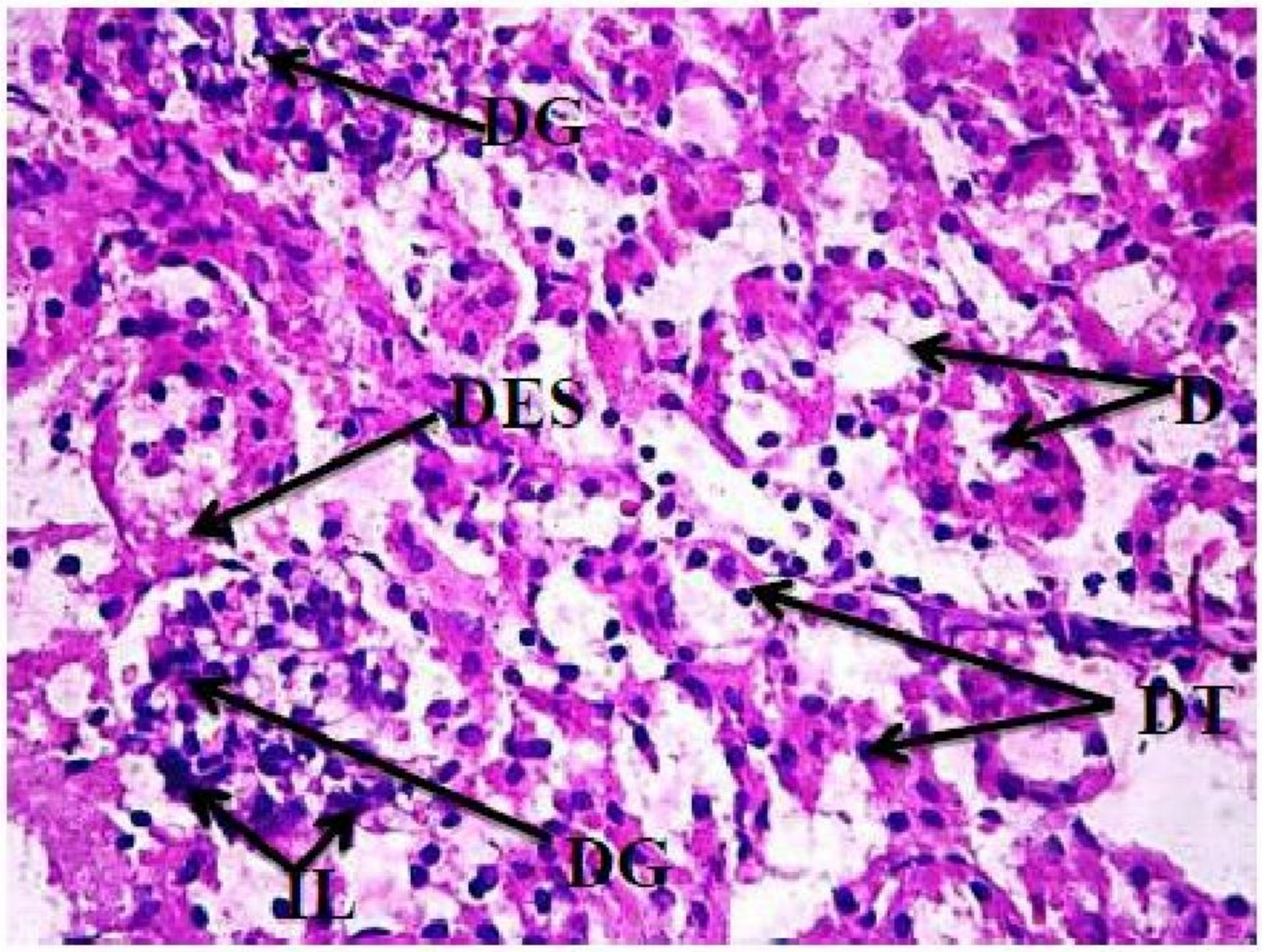

Figure (13): Kidney of pregnant mice administrated therapeutic dose showed Degeneration (D), Damage of Glomerulus (DG), Desquamation of epithelium cells (DES), Destruction of Tubules (DT) and Infiltration lymphocyte (IL) (H&E 400X)

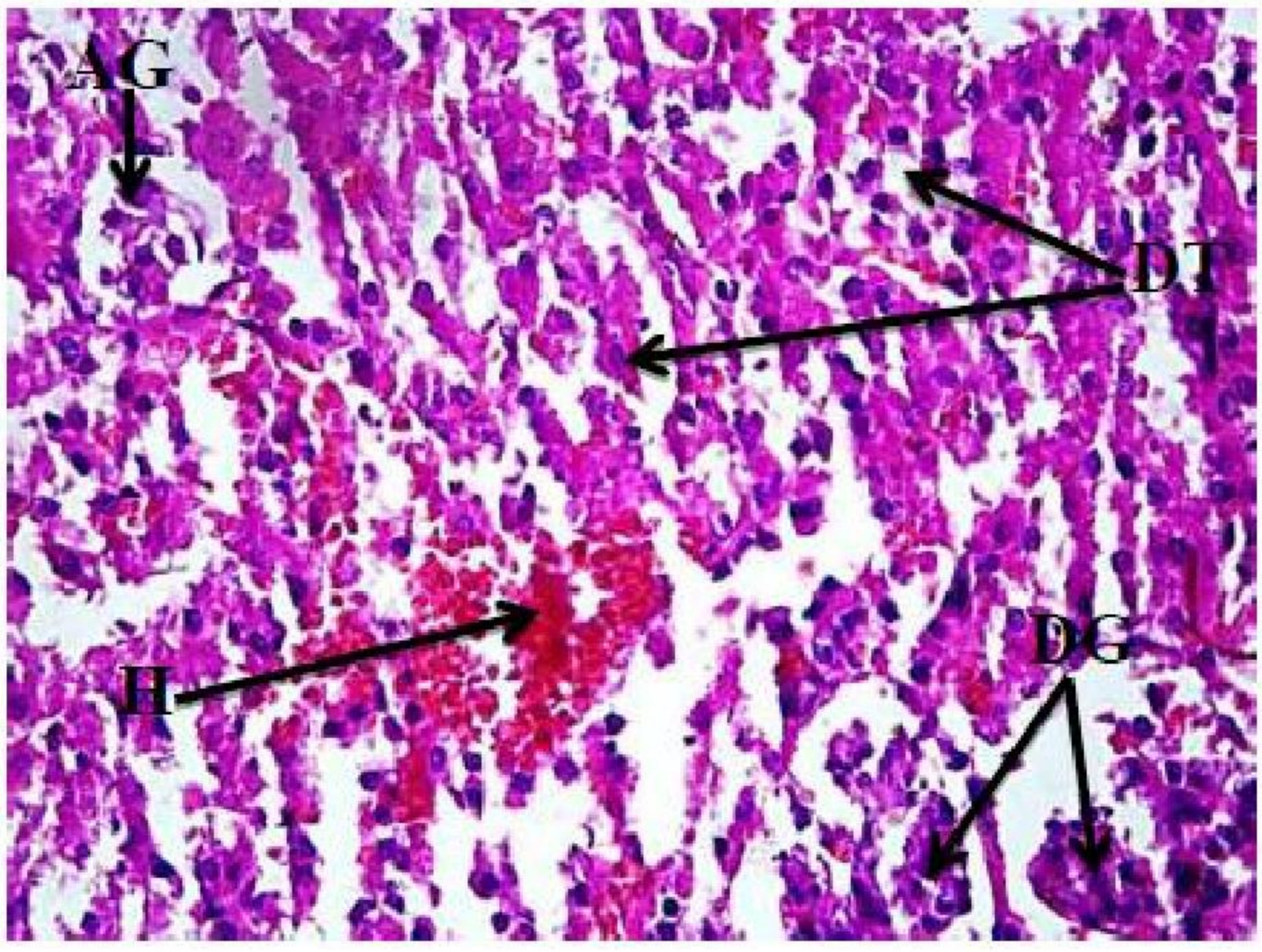

Figure (14): Kidney of pregnant mice administrated hyper dose showed Destruction of tubules (DT), Atrophy of Glomerulus (AG), Damage of Glomerulus (DG) and Hemorrhage (H) (H&E 400X)

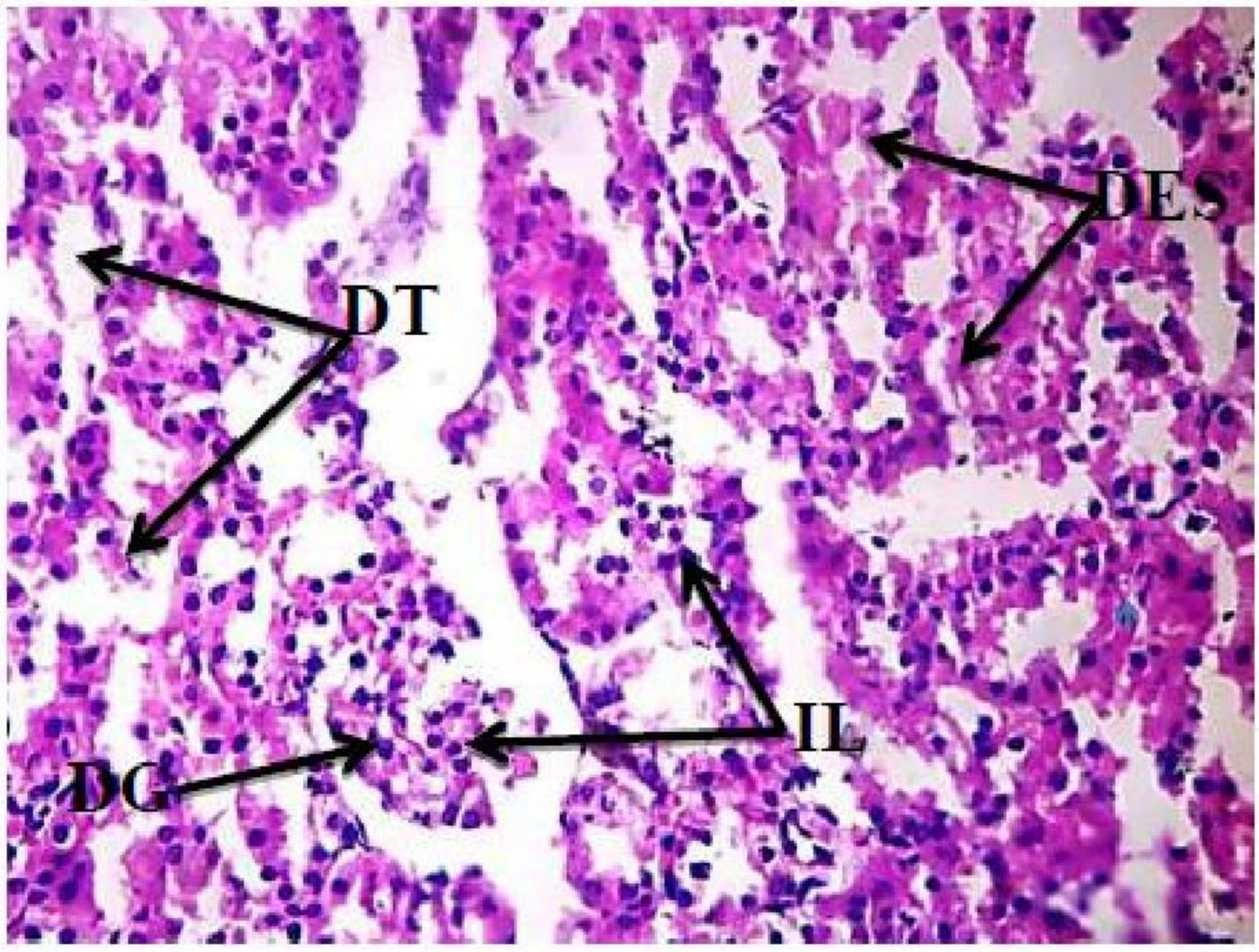

Figure (15): Kidney of pregnant mice administrated hypo dose showed Destruction of Tubules (DT), Desquamation of epithelium cells (DES), Infiltration Lymphocyte (IL) and Damage of Glomerulus (DG) (H&E 400X)

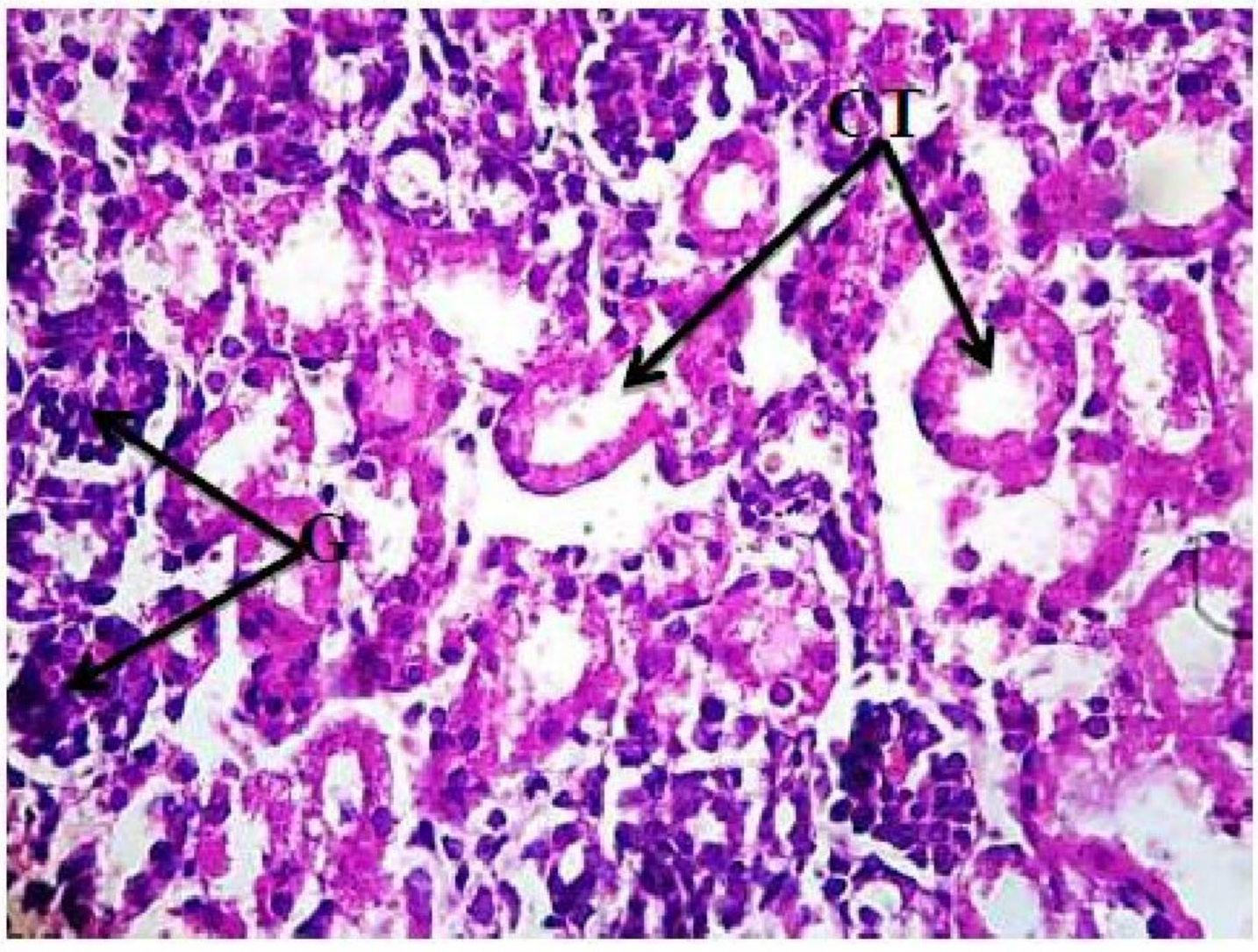

Figure (16): Kidney of control pups showed Glomerulus (G) and Conducting Tubules (CT) (H&E 400X)

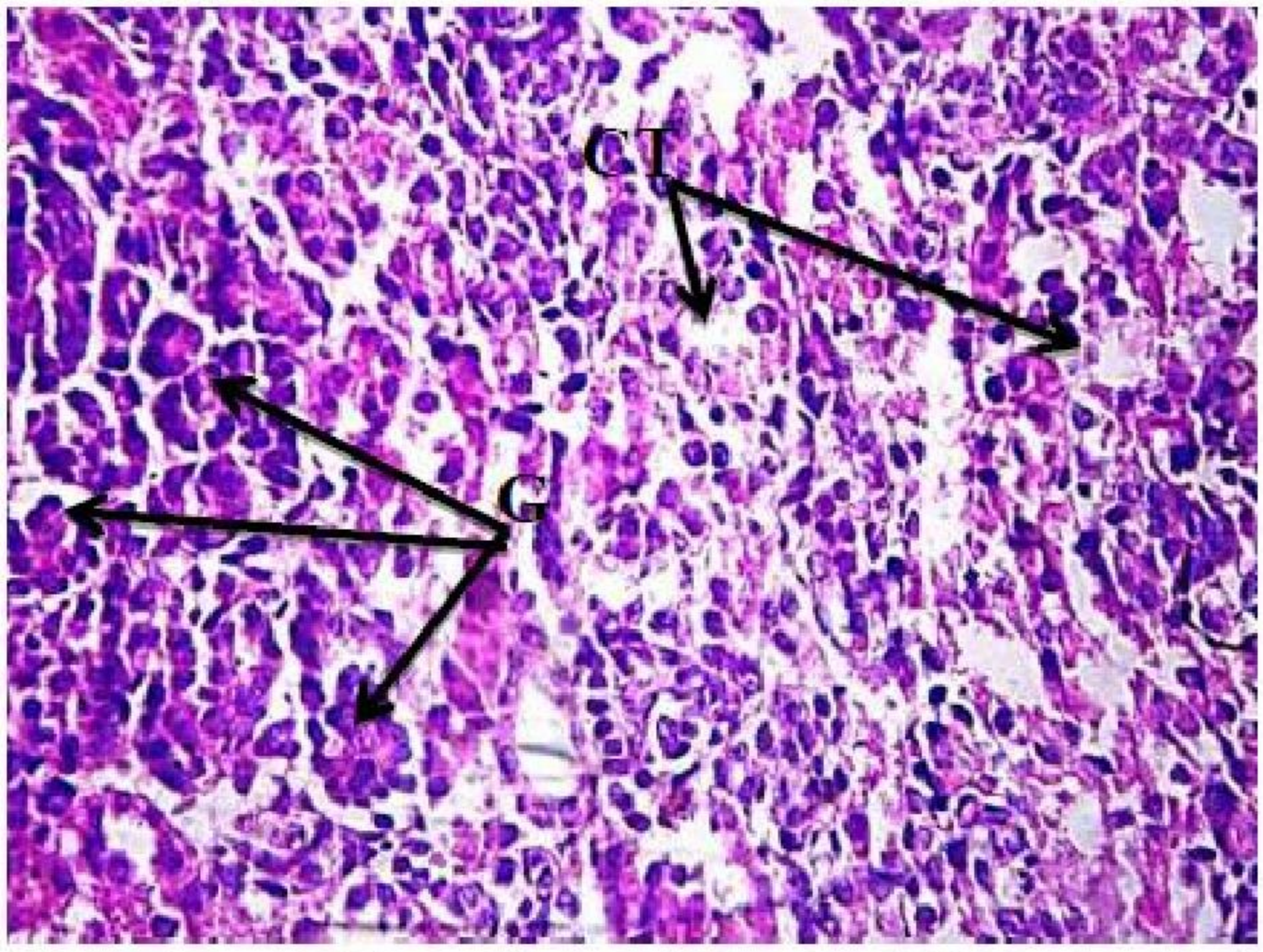

Figure (17): Kidney of pups administrated therapeutic dose showed Glomerulus (G) and Conducting Tubules (CT) (H&E 400X)

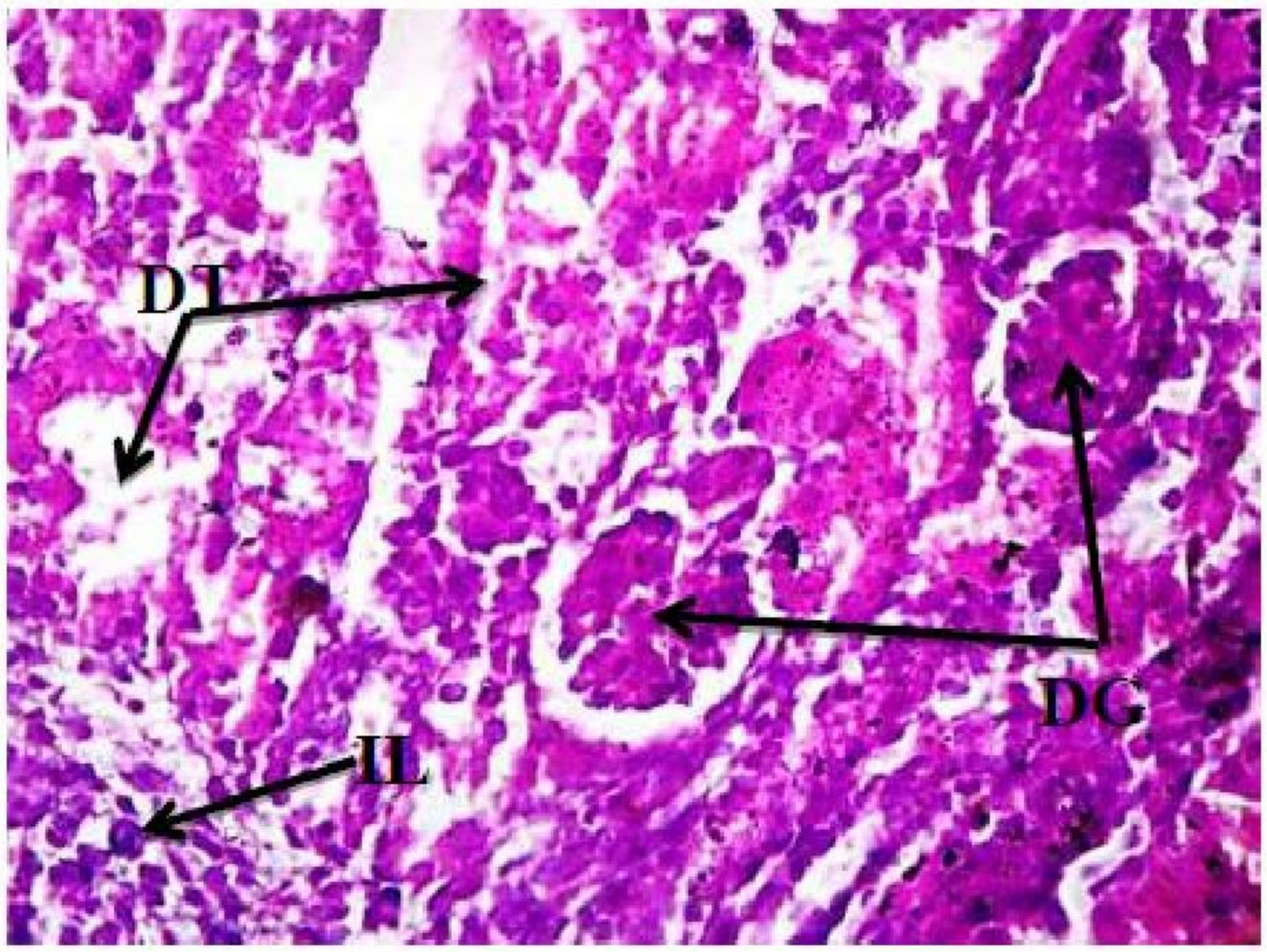

Figure (18): Kidney of adult male mice administrated hyper dose for 30 days showed Infiltration Lymphocyte (IL), Destruction of tubules (DT) and Damage of Glomerulus (DG) (H&E 400X)

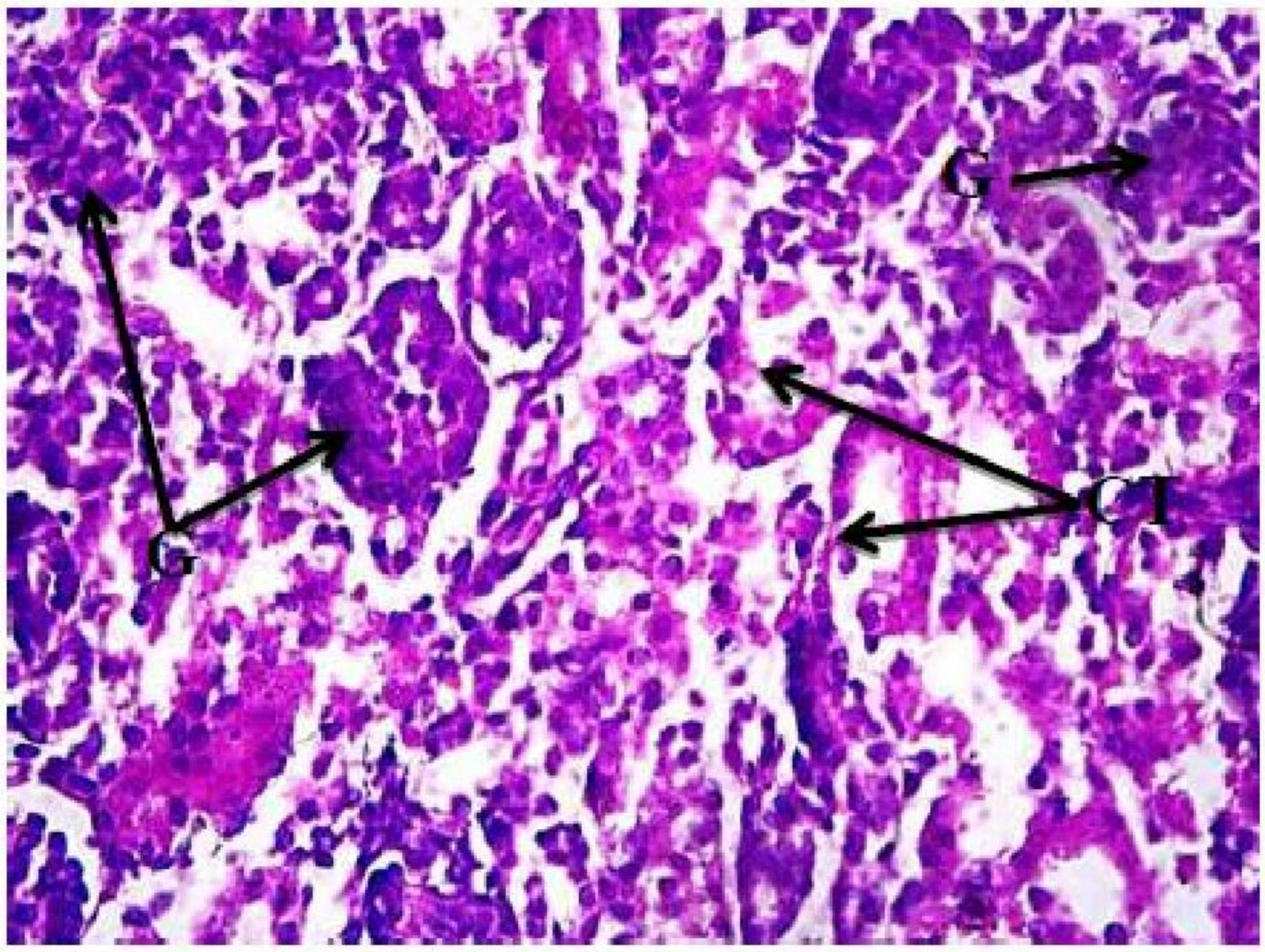

Figure (19): Kidney of pups administrated hypo dose showed Glomerulus (G) and Conducting Tubule (CT) (H&E 400X)

Discussion

The results of the present study showed statistically a non-significant decrease of kidney weight in therapeutic dose group compared with control, and high significant ($p \leq 0.01$) decrease in hyper and hypo dose group compared with control group. Where as after study sections of the kidney, it was found that there were degeneration of lining cells, infiltration of lymphocytes and hemorrhage . This results were agreed with [9] study of the effect of ethanolic extract of terminalia arjuna stem bark in alloxan - induced diabetic rats. They found it cause infiltration of lymphocytes, hemorrhage that cause increase of kidney weight . The kidney showed edematous and more congested, or more greenish with presence of fat on the surface of the kidney. These changes abscesses, when the kidneys to become inflamed, when the capsule was stripped from the cortical surface pus was released from the most superficial of them and appeared large yellow spots . There was complete necrosis of the renal tubular cells [10] and this is in agreement with the present result .

The microscopic examination showed . the blood capillaries destruction of glomerulus were destruction that lead to hemorrhage in glomerulus also hemorrhage between .

the tubules caused by destruction of blood vessels also there were infiltration of lymphocytes , degeneration were present in some epithelial cells that lining the convoluted tubules. Similar results, have been reported by [11] .

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تأثير آيوديد البوتاسيوم على الكلية في الفئران البيض *Mus musculus* وأجنتها

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(تاريخ الاستلام: 12 / 9 / 2012 ---- تاريخ القبول: 6 / 5 / 2013)

الملخص

أجريت الدراسة الحالية للتعرف على تأثير فعالية آيوديد البوتاسيوم على أحداث التشوهات العيانية والآفات النسجية المرضية في الكلية لدى الفئران الذكور البالغين والفئران الحوامل نوع *Mus musculus* واجنتها .

أظهرت نتائج الدراسة الاحصائية عدم وجود فروقات معنوية في وزن الكلى لمجموعة الجرع العلاجية ، الواطئة والمفرطة لمجموعة الفئران الذكور البالغين مقارنة مع مجموعة السيطرة ، في حين أظهرت الاحصائيات انخفاضا معنويا عاليا في وزن الكلى لمجموعة الجرعة المفرطة والواطئة لمجموعة الفئران الحوامل . أظهر الفحص النسيجي آفات عديدة في الكلية لمجموعة الفئران الذكور البالغين والفئران الحوامل . تمثلت هذه الآفات ارتشاح الخلايا اللمفاوية ، تنكز، تنخر، انكماش ونزف .