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Study the toxic effect of lead acetate on kidney, lung and liver tissues in Albino mice *Mus musculus*

دراسة التأثير السمي لخلات الرصاص على أنسجة الكلية والرئة والكبد في الفئران البيض *Mus musculus*

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Abstract:

The present work seeks to examine the histopathological changes in kidney, lung and Liver tissue of mice which exposed to lead acetate. Sixteen healthy mouse were divided into four groups each group of four animals and the first group was kept as un-medicated control while, the second, third and fourth groups were given Lead acetate at a dose of 18 mg/kg for one, two and three weeks respectively Lead acetate was given by oral route. In the experiment's end, the exposed mice with LA were sacrificed and the main target tissues such as kidney, lung and liver were collected for histopathological study. The results of this study proved that kidney lesions shows congestion, degeneration and mild chronic inflammation compared with control group. The lung histopathological alternates shows moderate congestion, mild mixed inflammation and hemosidren deposition. As well as the changes in liver showing lobular disarrangement, congestion, moderate portal and lobular hepatitis was also observed. the present study proved that heavy metal containing lead have toxicological effects on the target organs.

الخلاصة

هدف العمل الحالي إلى دراسة التغييرات النسجية المرضية في أنسجة الكلية والرئة والكبد للفئران البيض المعاملة بخلات الرصاص. فقد تم اخذ ستة عشر فار صحيح قسمت إلى أربعة مجاميع وتضمنت كل مجموعة أربعة حيوانات. تمثلت المجموعة الأولى بمجموعة السيطرة التي بقيت دون معاملة أما المجموعة الثانية والثالثة والرابعة فقد تم معاملتها بخلات الرصاص فمويا بتركيز 18 ملغم/ كغم من وزن الجسم لمدة أسبوع واحد وأسبوعين وثلاثة أسابيع على التوالي. تم جمع الأنسجة المطلوبة من الحيوانات المعاملة وحيوانات السيطرة بعد التضحية بها في نهاية التجربة.

أثبتت نتائج الفحص ألمجهري النسيجي لنسيج الكلية وجود احتقان دموي وتنكص في الخلايا الكبدية مع التهاب مزمن بسيط بالمقارنة مع السيطرة السالبة التي لم تظهر أي تغييرات. أما نتائج فحص نسيج الرئة مجهربا فقد أظهرت حصول احتقان متوسط والتهابات مختلطة خفيفة وترسب لصبغة الهيموسدرين . بالإضافة إلى أن الفحص ألمجهري لنسيج الكبد اظهر تغيرات نسجية مرضية تمثلت بحصول احتقان دموي وتغير في ترتيب الفصوص الكبدية ، كما لوحظ حدوث التهاب في الفصيصات والوريد ألبابي الكبدي. هذه النتائج أثبتت أن للعناصر الثقيلة ومنها الرصاص تأثيرات سمية على الأعضاء المستهدفة.

Introduction

Lead in the environment is considered one of the most dangerous poisons and pollutants **[1].** Lead is so toxic element, and occupational exposure to lead defined by Hippocrates and Nikander more than 2000 years ago **[2].** Lead toxicity appears in multiple forms of neurological and intestinal signs. Hence, depending on the duration and level of exposure to this substance causes both acute toxicity and chronic toxicity **[3].** The assessments revealed that the liver of human who are exposed to lead is the biggest recipient compared with the other members. Also it found in treated laboratory animals that lead accumulates in shell of kidney and medulla. As it was found that exposure to lead in the environment increases the toxic influences on different members of the body. Reports in both animals and humans showing that lead has toxic influences on the bone, kidney, liver, lung, blood, heart, finally the testis and brain **[4].**

It considers paints containing lead are common sources of lead in animals. There is considerable variation in susceptibility for different species to be affected by lead or materials containing lead, which may affect on its toxicity. Hence, lead toxicity varies due to its chemical form. Solid lead

sheeting and insoluble lead oxides less toxic than soluble lead acetate. except the bone where the lead is remains an inert form, It is known that lead dose not remain in the tissue for a long time and the form which is freed from lead in bone later be enough to cause chronic lead poisoning **[5].** It is known that people who are exposed to heavy metals suffer from both hepatic and renal toxicity. Previous autopsy studies in the individuals which exposed to lead indicated that the liver is the largest repository of lead 33 %, followed by the kidney cortex and medulla between the rest of the soft tissues **[6].**

Material and method:

Material

Lead acetate:

The chemical formula of LA (3-hydrate lead acetate) manufactured by(BDH, limited pool/ England) used for this study had brought from storage of collage of science/ university of Karbala, as a powder form in concentration 99%. LA administered orally to mice after dissolved in distill water.

Animals:

Sixteen of albino mice weighed 23±2gm, were acclimated to laboratory conditions for seven days with an temperature ranging from 22 to 26 C. Mice were 6-8 weeks old, kept in Gages in the animal house in pharmacy collage, same food and water was provided to all.

Experiment design

The sixteen albino Swiss mice were divided into four groups each group have four animal.

1- The first group was received only distilled water which considered as a control.
2- The second group was received 18 mg/kg b.w. of lead acetate daily for 7 days.
3- The third group was received 18 mg/kg b.w. of lead acetate daily for 14 day.
4- The fourth group was received 18 mg/kg b.w. of lead acetate daily for 21 day.

All groups were received of lead acetate orally by gavage needle.

Histological Observations:

Liver, lung and kidneys were rapidly removed after anesthetize the animals with chloroform On completion of experiments. All the organs were fixed in 10% formalin and embedded in paraffin then 4 μm thick sections were prepared by rotary microtome and stained with hematoxylin and eosin dyes, according to the method of **[7]**. The sections were examined under an light microscope, and diagnosed for histological study.

Result & discussion

The results of kidney histopathological study shows the normal tissue in control group (Figure-1). While the histological alternation like degeneration, mild chronic inflammation and congestion occurred in mice kidney which exposed to lead acetate for one week (Figure-2). Two weeks of treatment showing moderate congestion and mild degeneration of tubules (Fig-3). While the results of three weeks of treatment with lead acetate showing sever congestion, degeneration of tubule and mild mixed acute and chronic inflammation (Figure-4) compared with control groups. The earlier results revealed that the exposure to lead has led to mild decline represented an expansion and congestion of blood vessels and blood leakage was occurred in kidney. Also, renal tubule damage that due to exposure to high levels of lead, it has been believed that this damage can be associated with accumulated dose of lead in kidney **[8]**. Also, **[9]** found that the treatment with lead hampered the natural histological configuration in kidney's tissue. These degenerative alternates represented in an Increasing the thickness of the basement membrane in the glomerulus, renal corpuscles increased in size and big vacuoles appeared in the endothelial cells of renal tubules. In a previous study showed that changes in the expression of the extracellular protein and Modulations in the ultrastructure of the cells due to chronic exposure to lead. These Changes represented in reduced of basement membrane thickness of glomerulus in kidney of treated rats **[10]**.

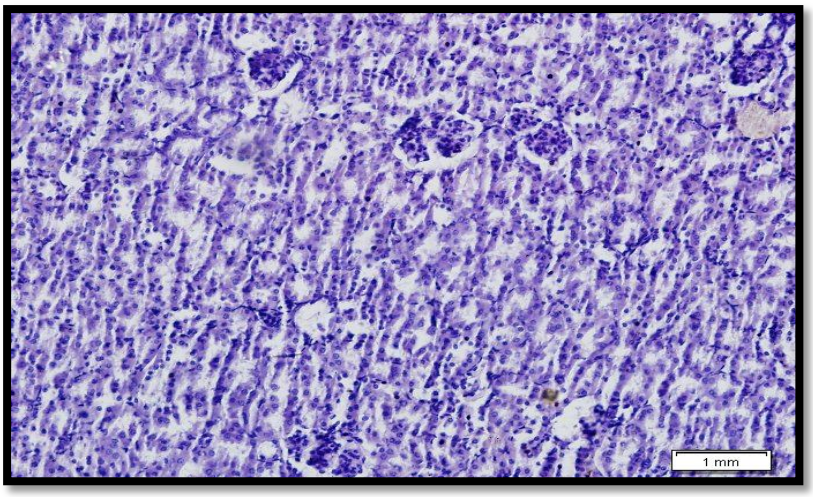

Fig.(1) kidney section of control group contain mild change (200x H&E)

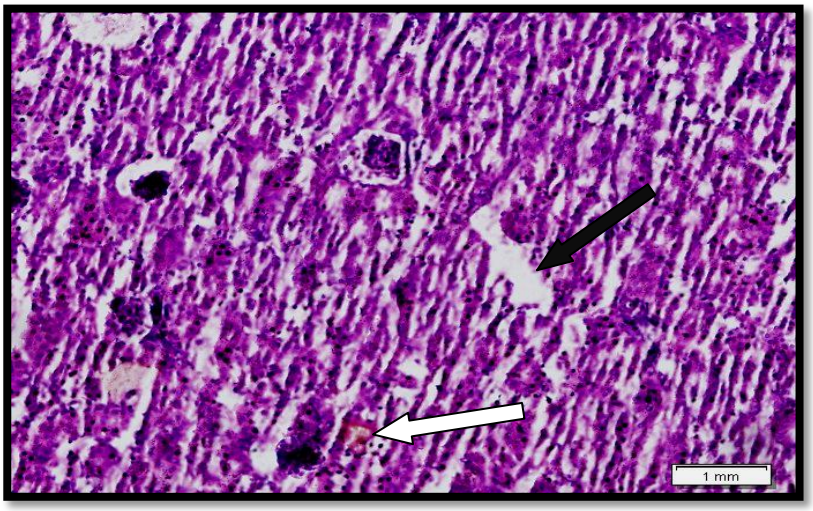

Fig. (2) kidney section of one week treated group with 18mg /kg lead acetate Degeneration(black arrow) and congestion(white arrow) (200X, H&E).

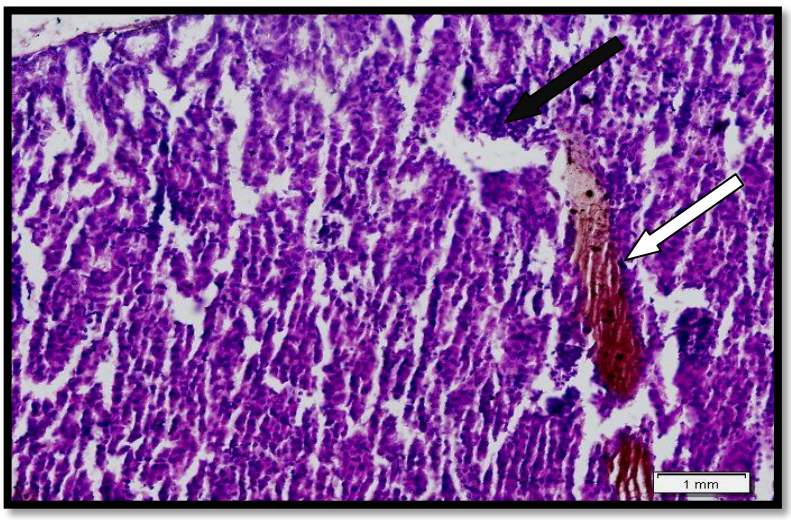

Fig. (3) kidney section of two weeks treated group with 18mg/kg lead acetate shows Moderate congestion(white arrow) and mild degeneration of tubles(black arrow) (200X, H&E).

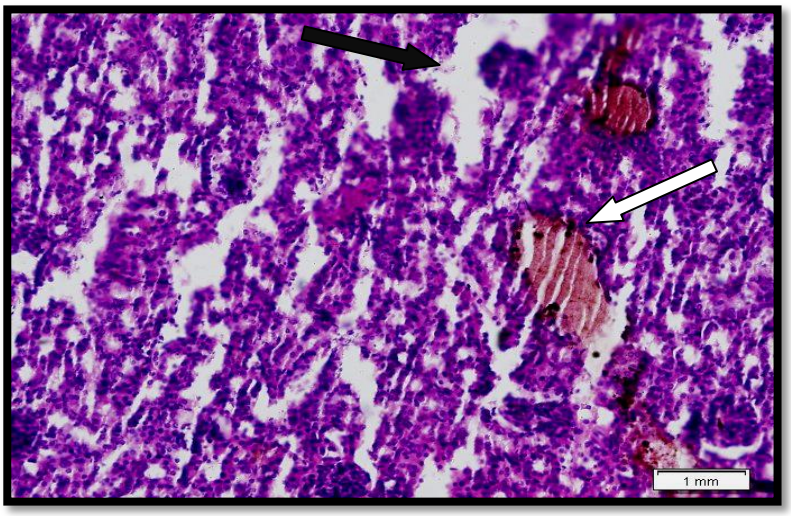

Fig. (4) kidney section of three weeks treated group with 18mg/kg lead acetate shows sever congestion(white arrow) ,degeneration of tubule(black arrow) , mild mixed acute and chronic inflammation (200X, H&E).

The lung histopathological alternates in mice which treated with 18 mg/kg of lead acetate for one week shows mild haemosidren deposition (Fig.6),while the two weeks results of treated shows moderate congestion ,mild mixed inflammation and hemosidren deposition (Fig.7), as well as the results for three weeks of treated with lead acetate shows congestion and moderate chronic inflammation (Fig8.) compared with control groups (Fig.5). Results proved that the lead injection causes the damaged lung tissue structure as a result of oxidative stress due to lead **[11]**. **[12]** found that the mixing lead with cadmium cause damage in male cells and has been associated with a decrease bronchial non- ciliated cells or Increasing loss it. And more necrosis and disarmament because of accumulation of lead in lung tissues, which is

associated with sex hormones due to lead oxidative stress. In the lung it is believed that the dust and heavy metals caused necrosis, degenerative alternates and interstitial fibrosis **[13]**. Adopt the influence degree of inorganic dust on lungs on the type of dust, duration and amount of the dose **[14]**.

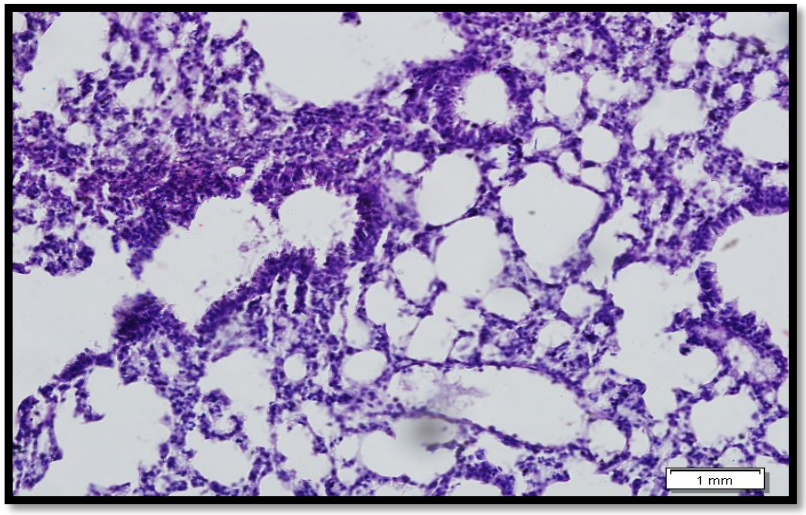

Fig.(5) lung section of control group shows normail size alveoila (200X H&E) .

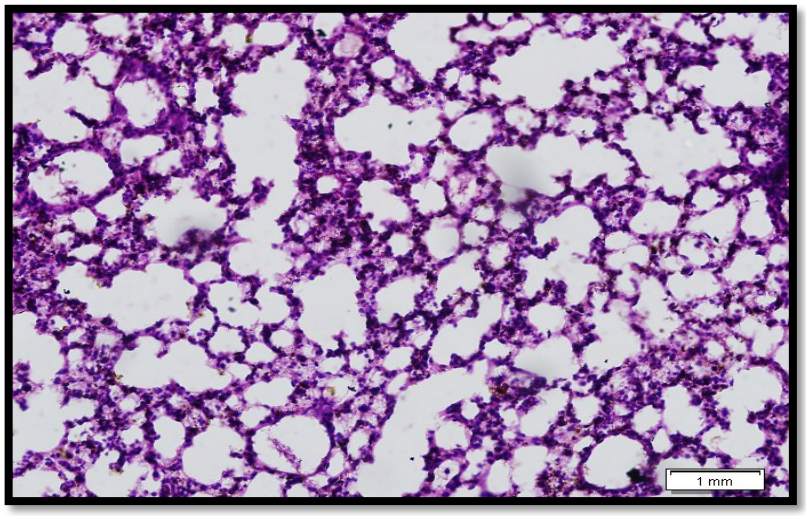

Fig.(6) lung section of one week treated group with 18mg lead acetate shows mild haemosidren deposition (200x, H&E).

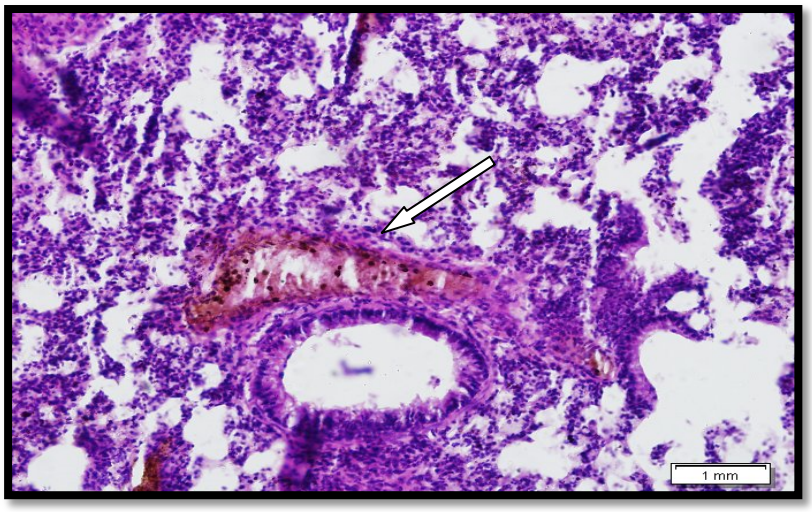

Fig. (7) lung section of tow week treated group with 18mg /kg lead acetate shows moderate congestion(white arrow) ,mild mixed inflammation and hemosidren deposition (200X, H&E).

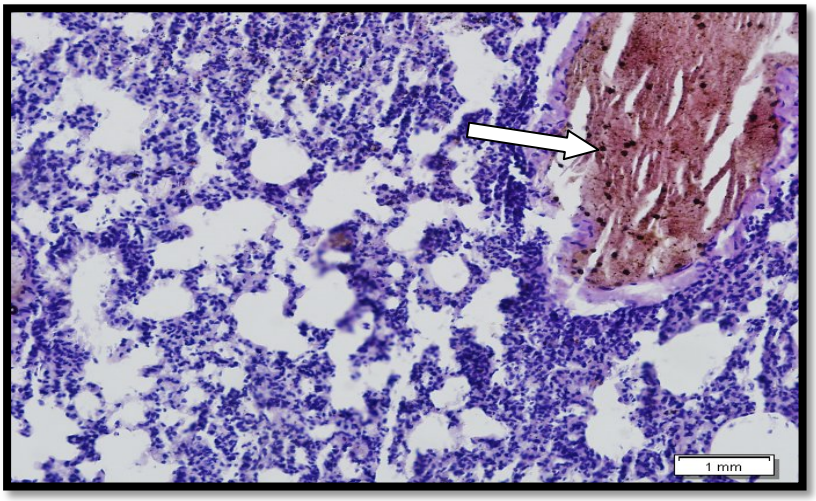

Fig. (8) lung section of three week treated group with 18mg/kg lead acetate shows congestion(white arrow) and moderate chronic inflammation (200X, H&E).

Also, The liver histopathological changes in mice which treated with 18mg/kg of lead acetate shows mild degeneration, lobular dissarangment with congestion and mild chronic inflamation for one week from treated (fig-10). While the result for two weeks from treated shows in (fig-11) mild congestion, lobular dissarangment and mild-moderate chronic inflammation. However (fig-12) shows lobular dissarangment, congestion, moderate portal and lobular hepatitis, these changes in liver mice treated with LA for three weeks compared with the normal state in control group (fig-9). **[15]** reported that the acute treatment with lead for one week led to severe damage in liver cells, absence of arrangement of the hepatic cells and expansion of blood sinusoids. Also **[16]** found the Chronic exposure to lead leads to appearance of inflammatory cells in liver tissue, perhaps as a result to interact lead with enzymes and proteins of liver tissue, interfering with the mechanism of antioxidant defense to produce a traditional inflammatory response as a result of the generation of reactive oxygen species(ROS).

In another related study **[17]** confirm that the cause of pathological changes in the liver tissue could be as a result to lead action on the content of DNA, liver glycogen and portability of lead to convert amino acids into proteins.

Recent studies have suggested that the reason of the pathophysiology changes in the liver may due to oxidative stress, or programmed cell death (apoptosis), Although the mechanism of lead action that causing hepatic toxicity is not much clear **[18].**

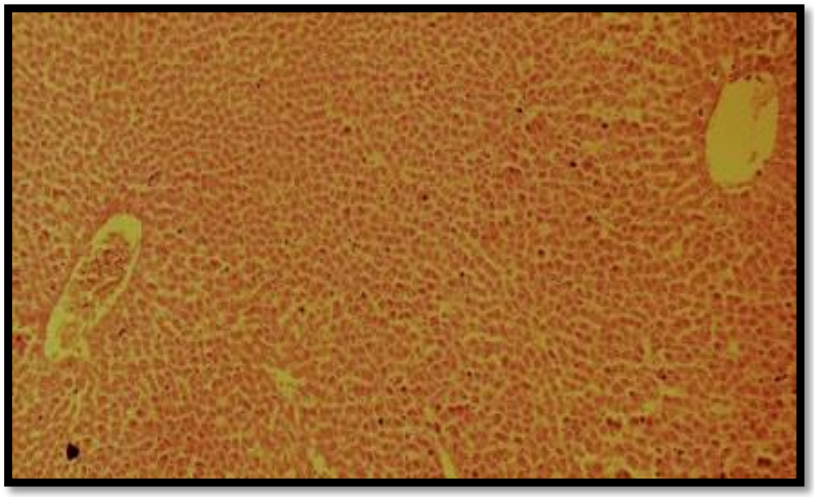

Fig (9) section in liver of mice treated with distilled water (control group) shows no histopathological changes (100X, H&E).

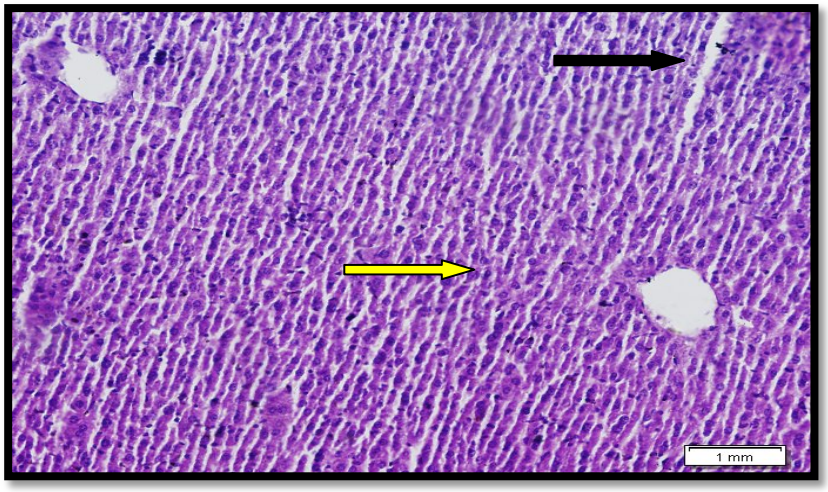

Fig (10) section in liver of mice treated with 18mg/kg LA for one week shows mild degeneration (black arrow), lobular dissarangment (yellow arrow) and mild chronic inflamation (200X, H&E).

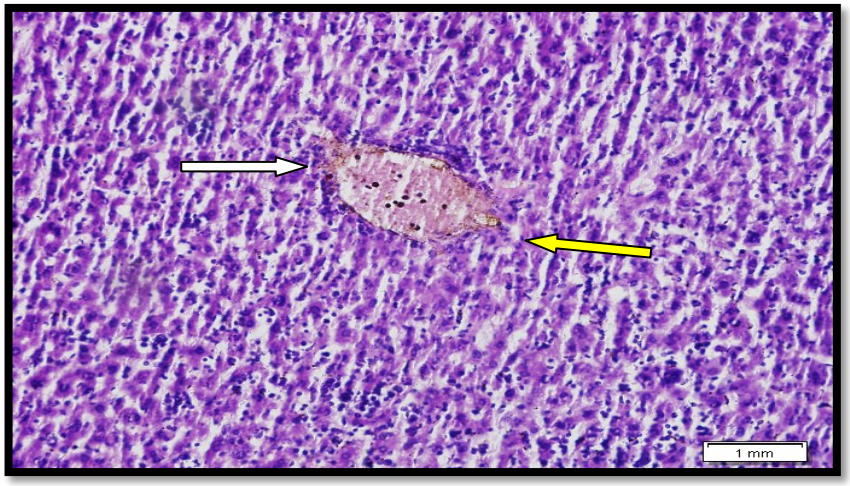

Fig (11) section in liver of mice treated with 18mg/kg LA for two weeks shows mild congestion (white arrow), lobular dissarangment(yellow arrow) and mild-moderate chronic inflammation (200X, H&E).

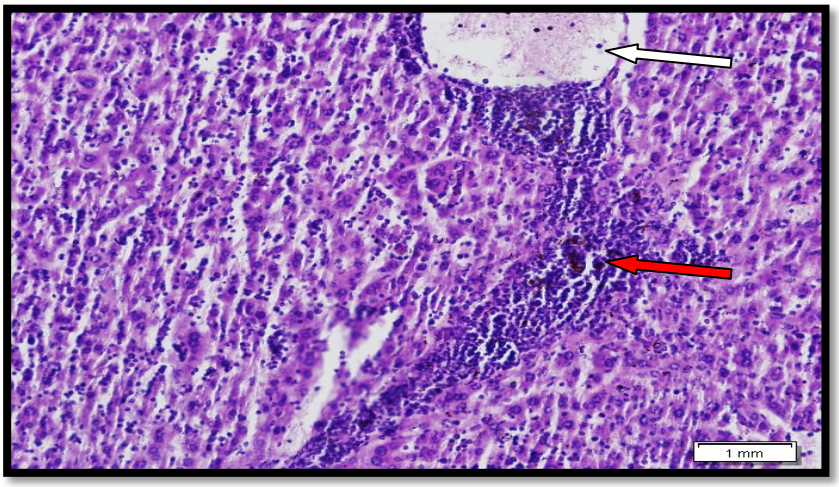

Fig (12) section in liver of mice treated with 18mg/kg LA for three weeks shows congestion(white arrow), lobular dissarangment, moderate portal and lobular hepatitis(red arrow) (200X, H&E).

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