Pathological & Residues study of Cadmium Chloride in rabbits

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Summary

In the present research, the pathological effect of $CdCl_2$ residue study was done on white male rabbits. 42 white male rabbits were randomly divided into 2 groups : 1st group included 30rabbits were given $CdCl_2$ 13 Mg / kg / day for 12 weeks via drinking water .2nd group included 12rabbits fed on normal rabbit diet .The following parameters were observed on the above groups:

1- Clinical signs: Treated rabbits showed, vomiting and bloody diarrhea .
2- Residual investigation on liver and kidney : $CdCl_2$ residue present more significant in liver and kidney mostly at 8 and 12 weeks : 108.0 ,447.0 mg/kg dry weight in liver and 113.1,447.0 mg/kg dry weight in kidney respectively .
3- Histopathological changes: The liver & kidney of treated rabbit showed in liver and kidneys typical form of macrophage granuloma surrounded by fibrous connective tissue.

دراسة نسجية مرضية لكلوريد الكادميوم ومتبقياته في الارانب

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الخلاصة

أجري البحث الحالي لدراسة التأثير المرضي لكلوريد الكادميوم ومتبقياته في الأرانب البيض قسمت 42 من ذكور الأرانب البيض عشوائياً الى مجموعتين : المجموعة الاولى (المعاملة) , شملت 30 ارنباً جرعت كلوريد الكادميوم $CdCl_2$ بماء الشرب 13 Mg / Kg /day لمدة 12 أسبوع , أما المجموعة الثانية (سيطرة) تضمنت 12 أرنباً غذيت على عليقة الأرانب الأعتيادية ,

درست المعايير التاليه على المجاميع اعلاه:

1- الأعراض السريرية اظهرت الحيوانات المعامله التقيؤ والاسهال الدموي

2- قياس متبقيات كلوريد الكادميوم في نسيج الكبد والرئة:كانت متبقيات كلوريد الكادميوم مهمه في الكبد والكليه خاصة في الاسبوع الثامن والثاني عشر (108و447ملغم /كغم وزن جاف في الكبد و 113.1 و447ملغم /كغم وزن جاف في الكليه على التوالي..

3- التغيرات المرضية النسجية:اظهرا الكبد والكلية في الحيوانات المعامله الشكل النموذجي للاورام الحبيبيه الناضجه محاطه بالنسبج الضام.

Introduction

Cadmium toxicity has a wide variety of sources in the environment particularly from industry. One source is from ingestion of foodstuffs especially grain and leafy vegetables which readily absorb Cadmium from the soil. (1)

Cadmium may occur naturally or as a contaminant from sewage sludge, fertilities polluted ground water and mining effluent (1).

Cadmium is also a constituent of alloys, pigments, batteries, metal coatings like plastic and steel. Cigarettes and fumes from vehicles contain 0.007-0.35 Mg/kg,. residential sites may be contaminated by municipal waste or leaks from hazardous waste site (2).

Cadmium is transported in the blood and widely distribute in the body but accumulates primarily in the liver and kidneys (3, 4).

Long exposure to Cadmium primarily affects the kidneys, resulting in tubular proteinosis although other condition such as “Itai -Itai” disease may involve the

skeletal system. (4).The target organ for Cadmium toxicity after oral exposure is kidney (4)

The aim of the present research was to study the pathological effects of $CdCl_2$ and its residues in rabbit's tissues (Liver & Kidneys).

Materials and Methods

Animal groups: 42 white male rabbits used weighing 750-1025 gm , randomly divided into 2 groups: 1st group contain (30)rabbits exposed to 0.07 mmol $CdCl_2$ daily with drinking water (equivalent to 13 mg / Kg /day) for 12 weeks with normal rabbit diet .2nd group (12) served as control group and given a normal rabbits diet (5) .The duration of experiment was 12 weeks, the following parameters were studied.

a- Clinical signs.

b- Residual Investigation: Liver & Kidney specimens were taken at day 4, 8 and 12 weeks after treatment with $CdCl_2$ .Organ residue levels of Cadmium were determined by HPLC. liver and kidneys specimens dried in drying oven to constant weight (± 0.1 mg) in 20 ml beakers at 100 C ◦ ,however,CdCl2 residues was made according to that mention by AL-Kaisie (6).

c- Histopathological study :

Study of histopathological changes of liver and Kidney tissues was carried out on: (1 X 1) cm 3 r specimens at 4, 8 and 12 weeks, specimens were fixed with neutral buffered formalin (10 %), dehydrated by 70 % isopropyl alcohol and embedded in paraffin (7).

The blocks were sectioned at 7.5 microns, fixed to glass slide and stained with hematoxylin and eosin stain .For this study, 10 treated and 3 control rabbits were killed by ether.

Results

A) Clinical signs :

Treated rabbits showed vomiting; bloody diarrhea.This may be due to the toxic effect of the CdCl2 on the epithelial lining cells of gastrointestinal tract mainly stomach and intestine.

B)Residual investigation :

Table (1): $CdCl_2$ residues in rabbits liver and Kidneys at 4, 8 and 12 weeks after treatment.

Weeks	groups	Liver mg/kg	Kidneys mg/kg
4	Treated	82.1	80.2
	Control	-	-
8	Treated	108.0	425.1
	Control	-	-
12	Treated	113.1	447.0
	Control	-	-

-Residue analysis of rabbit's composite of 10 rabbit's treated and 4 rabbit's control.

The residue concentration is high in 8 and 12 weeks in liver and also in kidneys.

C) Histopathological changes:

The liver of treated rabbits with Cadmium specially at 8 and 12 weeks showed macrophages forming focal granulomas (figure : 1) mostly consist of macrophages surrounded by fibrosis , perilobular fibrosis which encircles various bile ducts (fig:2) & lymphocytes and mononuclear cells infiltration around central veins .

Kidneys (fig: 3) Showed intensity of renal damage especially at 12 weeks & macrophages were more abundant to form focal granuloma in interstitial areas which observed in the tubules (Fig: 4).

Discussion

Usaf (8) found that LD50 values for animals range from 225-890 mg / kg for elemental Cadmium, 63-88 mg / kg of $CdCl_2$ & 72 mg / kg Cadmium oxide which cause abdominal cramps nausea, clinical signs of poisoning, shock and death.

The metabolic transformation of Cadmium are limited to its binding to protein and non protein sulfhydryl groups and various macromolecules such as metallothionein which especially important in the kidneys and liver (9), Cadmium is excreted primarily in the urine and the long term of exposure to Cadmium affects the kidneys resulting in tubular proteinosis (10).

That features of rabbit's exposure to Cadmium chloride in drinking water demonstrate namely pathological alternations in the liver (5) .High level exposure to $CdCl_2$ induced proteinuria after six weeks (11, 12).

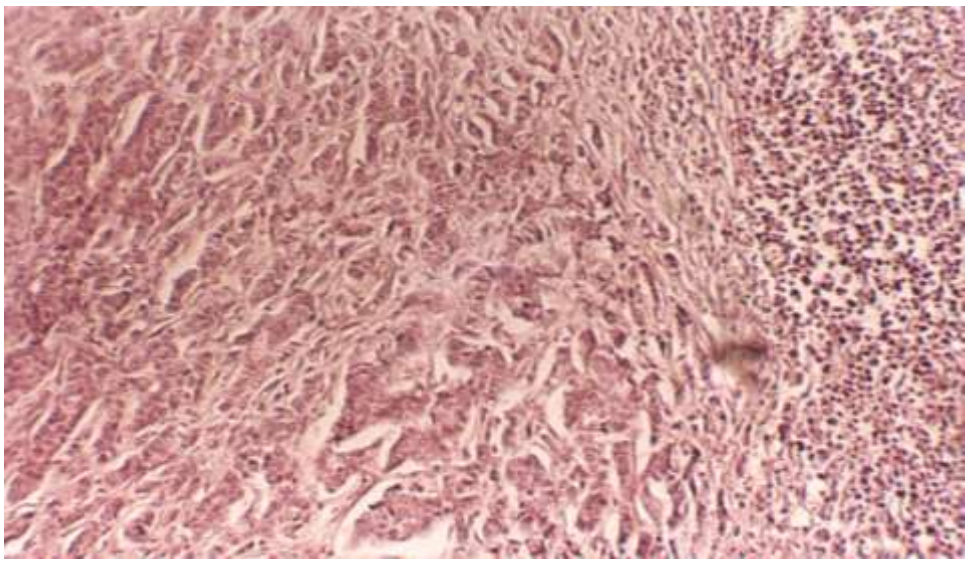

Fig (1): Liver of rabbits treated with $CdCl_2$:show macrophages forming focal granuloma(H & E stain X 40)

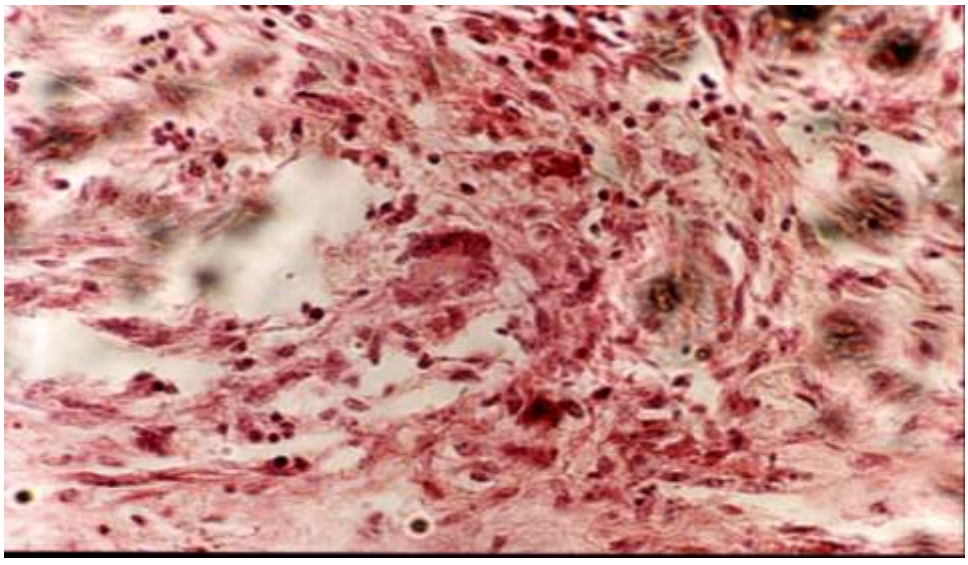

Fig (2): Liver of rabbits treated with $CdCl_2$: show perilobular fibrosis encircles the bile duct of the liver granuloma (H & E stain X 40)

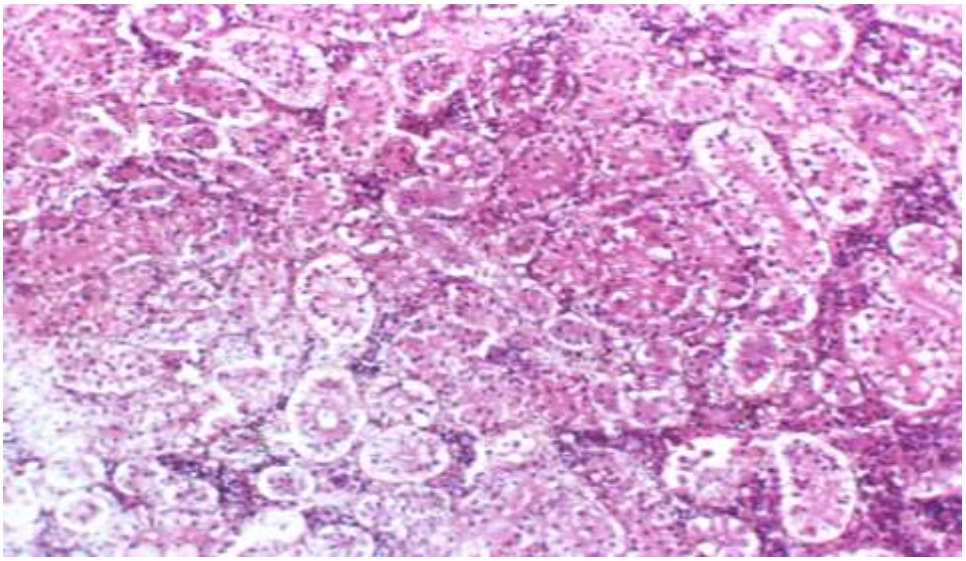

Fig (3): Kidney of rabbits treated with $CdCl_2$: Show Intensity renal damage (H & E stain X 40)

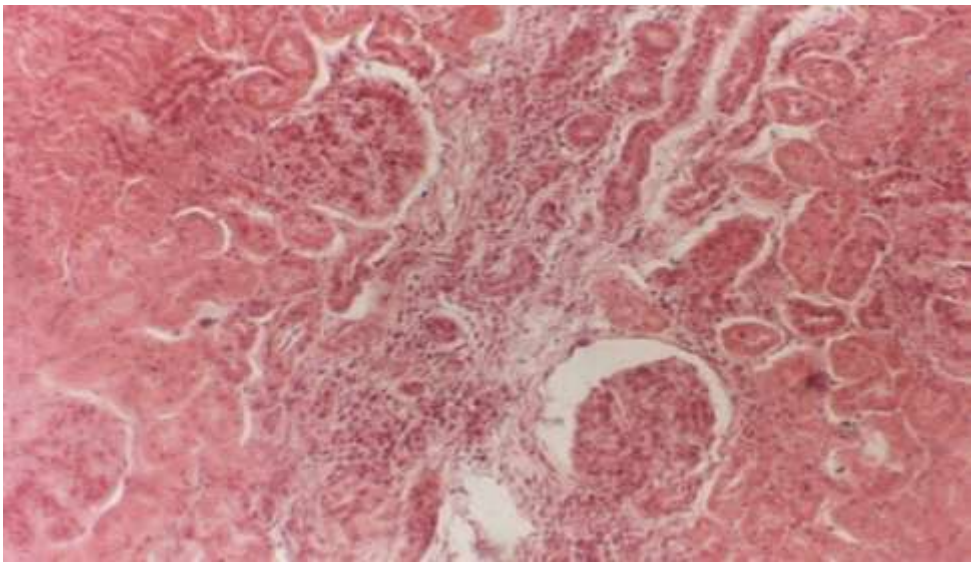

Fig (4): Kidney of rabbits treated with $CdCl_2$: Show renal focal granuloma (H & E stain X40)

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