Effect of Formalin Vapour on The Kidney of Rabbits

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Summary

The purpose of this study was to evaluate the effect of formaldehyde on the kidney of rabbits.

Treated animals were housed in closed room and exposed to formaldehyde fume using 10% formalin solution for a period of six months. Exposure was twenty-three hours for the whole period of the experiment, though one hour a day was left for ventilation. Control group was exposed to distilled water humidity.

Histopathologically, there were glomerulonephritis, congestion, cellular infiltration in addition to other changes.

تأثير بخار الفورمالين على كلية الأرانب

بهاء فخري الحسني
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الهدف من هذه الدراسة تحديد تأثير بخار الفورمالين على كلية الارانب.
وضعت الحيوانات في غرفة مغلقة وعرضت لبخار الفورمالديهايد باستعمال 10% محلول الفورمالين على مدى ستة أشهر في حين عرضت مجموعة السيطرة الى بخار الماء المقطر فقط.
فترة التعريض كانت على مدى 23 ساعة يومياً طول فترة التجربة وساعة واحدة للتهوية.
اظهرت الدراسة النسيجية للكلية حدوث تغيرات في الكبيبة والنسيج الخلالي والقنيوات. فضلاً عن ظهور التهاب الكبيبات مع احتقان وارتشاح خلوي.

Introduction

Formaldehyde as a chemical compound has been known for a long time as a disinfectant and preservative for biological specimens. Butlervo (1) prepared it and Blum (2) had used it for carcases preservation. Since then, it's usage has been spread in different aspects of chemical industries.

Formaldehyde is a gas highly soluble in water. Therefore, it is naturally absorbed in the upper part of the respiratory system (3). It is different from the rest of aldehydes by not having the alkyl group which gave it the importance of increased activity (4).

It has been reported that formaldehyde may induce kidney infection and disease due to its toxicity and irritability.

Besides, its toxicity may causes nephrosis like other of toxic substances, including salts of mercury, thallium or any chemical material(5).

This project was undertaken to determine the long term effect of formaldehyde vapour on the kidney of rabbits.

Material & Methods

30 adults, males and females of different ages ranging in weight between 550g – 1500g, at were used in this study, they divided into five experimental groups (five animals treated and one control in each group). Treated groups were caged in a closed room and exposed to formaldehyde vapour by using open pans contained 10% formalin for 23 hours a day. Control group was exposed to distilled water humidity. One hour was left daily for ventilation during which fresh solution was used.

The quantity of formalin solution needs was calculated by placing known volume of 10% formalin solution under a known volume dissicater and left for 24hrs. at room temperature (20 – 22 °C), at the second day, the solution was measured and by simple calculation, the quantity of formalin needed was determined.

Further, test tubes containing 5 C.C. of sodium bisulfite was placed under a hood to detect formalin concentration by using spektral photometer PM2A (Zeiss, west Germany) wave length 411 (T_{10} unexposed formalin to $T_{91.5}$).

The first group was sacrificed after two months, then every month a group was followed till the end of the experiment. Specimens of kidney were collected, fixed. Slides were prepared and stained with the Harris hematoxylin and Eosin.

Result

In the kidney, the result showed cellular infiltration of inflammatory cells were clear in the renal interstitial tissue and most of them neutrophilic granulocytes and mono nuclear cells (Fig. 1). In the second group, focal or diffuse glomerulonephritis will be observed with marked of inflammatory foci and the presence of different sizes and shapes of necrotic masses different in the size and shape, while in the third group, the result revealed glomerulitis with mild increase of (neutrophils) narrow of the Bowman's space (Fig. 2). Besides there were, mild increase of plasma cells and some glomeruli were appeared normal and others and degenerated.

In fourth group, renal interstitium with renal tubules system were obvious, as well as aggregation of inflammatory cells form from the lymphocytes, plasma cells and decreased number of eosinophilis observed in this inflammation odema and interstitial fibrosis with different degree of atrophy tubules, renal interstitium changes above mostly found consist or may scattered foci in renal parenchymal tissue and may be possibly to lititated some of them to form focally extensive areas (Fig. 3).

In fifth group, congestion of blood vessels and filtration of inflammatory lymphocytes and plasma cells with increased of fibroblasts activity was observed. In the glomerculus there was obvious atrophy will characterized as small glomerulus with

periglomerulor fibrosis in the inflammatory area, also there was congestion in the glomerulus capilleris which lead to narrow of Bowman's space (Fig. 4, 5).

Finally, cloudy swelling of renal tubules and filtration of lymphocytes, macrophages and some of plasma cells were observed perivascular, periglomerular, and peritubular also there was cellular proliferation of fibroblasts in the interstitial tissue (Fig. 6).

Discussion

Cloudy swelling of renal tubules is a state of defense in the renal parenchymal tissue to resist continuos exposure of formaldehyde (6, 7). However, the presence of glumerulitis may lead to atrophic degeneration in exposure continue for long period of time (8, 9).

Cloudy swelling of rental tubules which comes from the effect of antigen (hapten) of formaldehyde result from continuos exposure may be a case similar to the effect of other chemical such as, salts of mercury, thallium and arsenic (10). Besides, the increasing in cellular proliferation of fibroblasts after the exposure of formaldehyde in rabbits may be due to its high solubility in the body cells fluid and carried to the blood stream (11), the kidney is regulate the water and salt concentration of the body and also remove foreign substances from the blood (12).

Lymphocytes, in general, appear at first stage of inflammation and these cells gradually increase in number until finally may be part of the tissue constituent. When inflammatory processes continue for long period of times, especially in chronic diseases, they aggregate together forming lymphoid tissue (13). Presence of lymphoid cells in the tissue especially during the process of convalescence is due to increase demand for protein to help in regeneration in cells and also to form new fibroblasts (13).

Congestion of blood vessels and hyperima were due to the effect on the wall of blood vessels which result in increase nutrient and oxygen to remove waste products. Increase capillary permeability resulted in oedema.

Finally, when inflammatory processes continue for long period of time, especially in chronic diseases, the inflammatory cells and necrotic masses will be appeared that is indication of the inflammation after aggregation together (14).

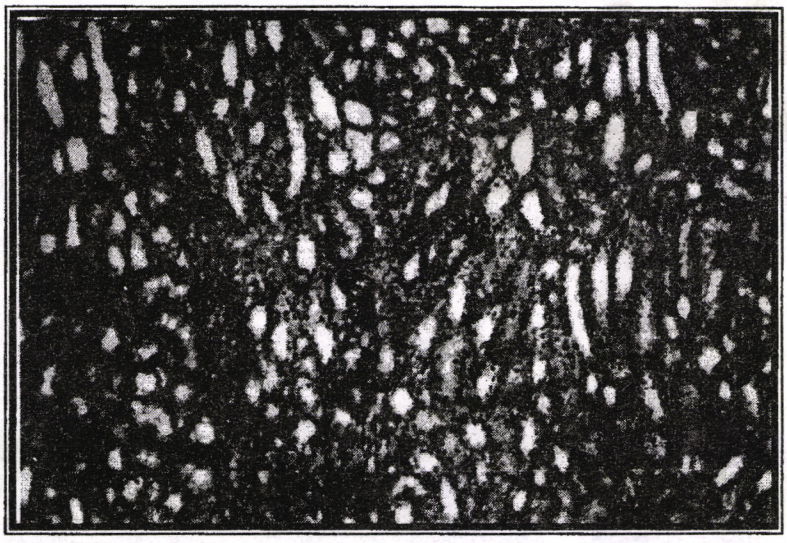

Fig. 1: Infiltration of inflammatory cells and congestion of blood vessels in the first group.

Harris hematoxylin and Eosin. Mag. 132X

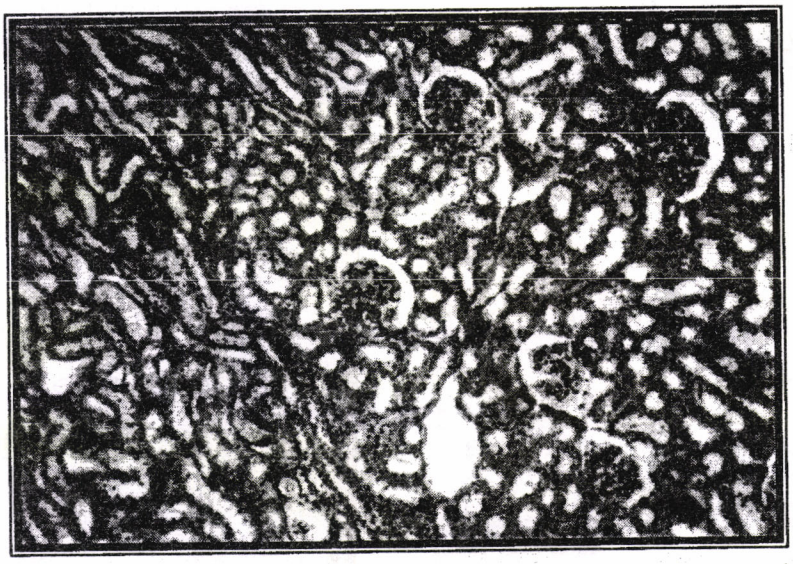

Fig. 2: Glomerulohephritis with mild increase of neutrophilis and necrotic masses marked of aggregation of lymphoid cells in the second and third group.

Harris hematoxylin and Eosin. Mag. 264X.

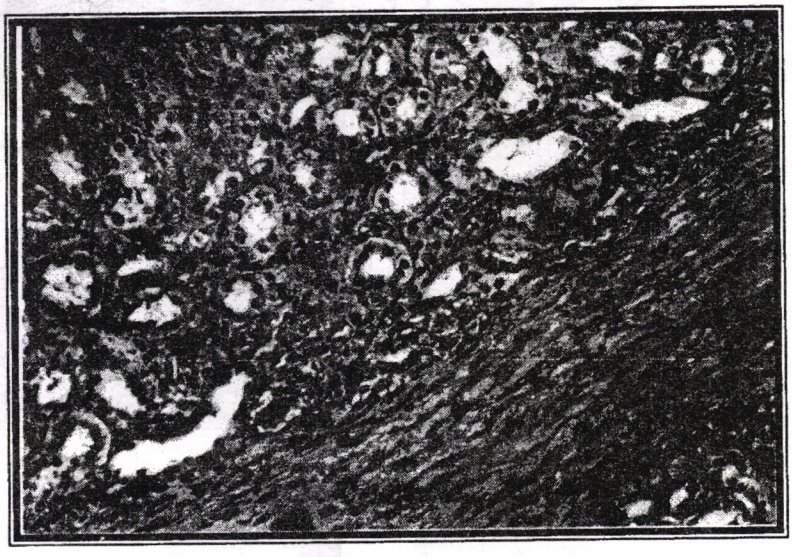

Fig. 3: Odema and intersitial fibrosis with the aggregation of inflammatory cells in the forth group. Harris hematoxylin and Eosin. Mag. 264X.

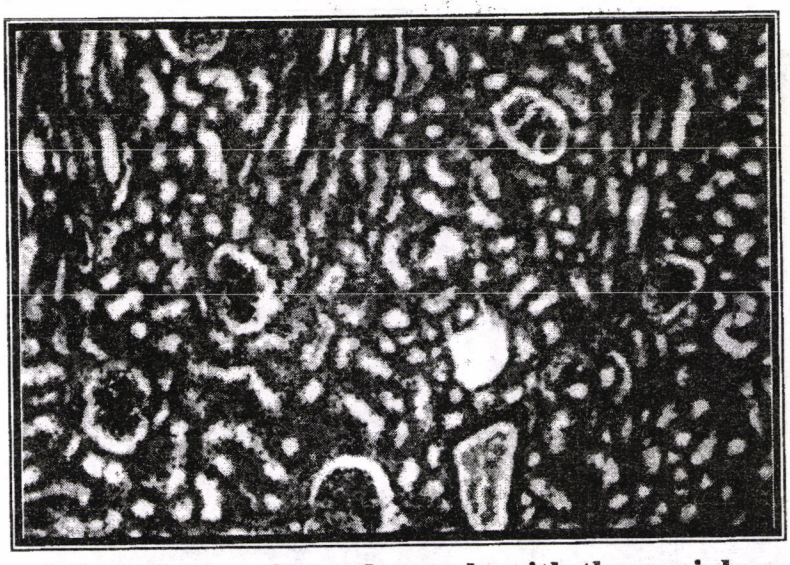

Fig. 4: Congestion of blood vessels with the periglomerular fibrosis in the fifth group.

Harris hematoxylin and Eosin. Mag. 132X

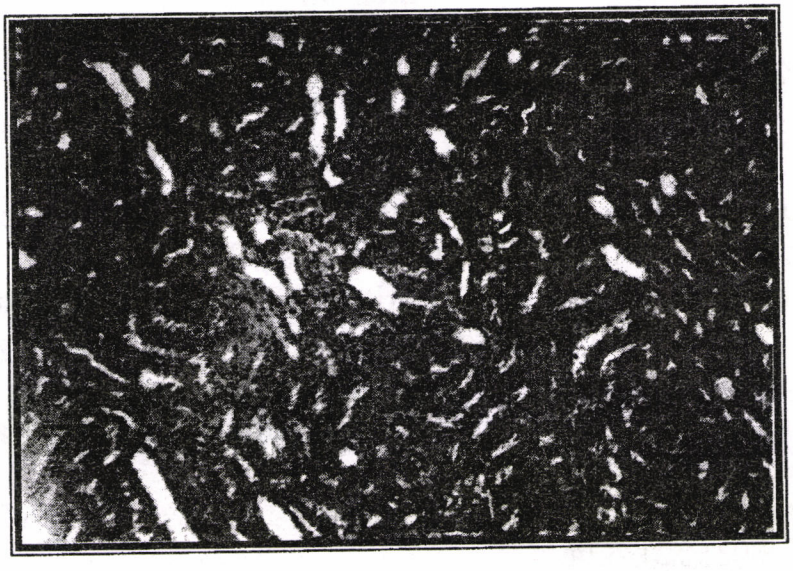

Fig. 5: Increased of fibroblasts with infiltration of inflammatory cells lymphocytes & plasma cells and congestion of glomerulus capillaries in the fifth group.

Harris hematoxylin and Eosin. Mag. 264X.

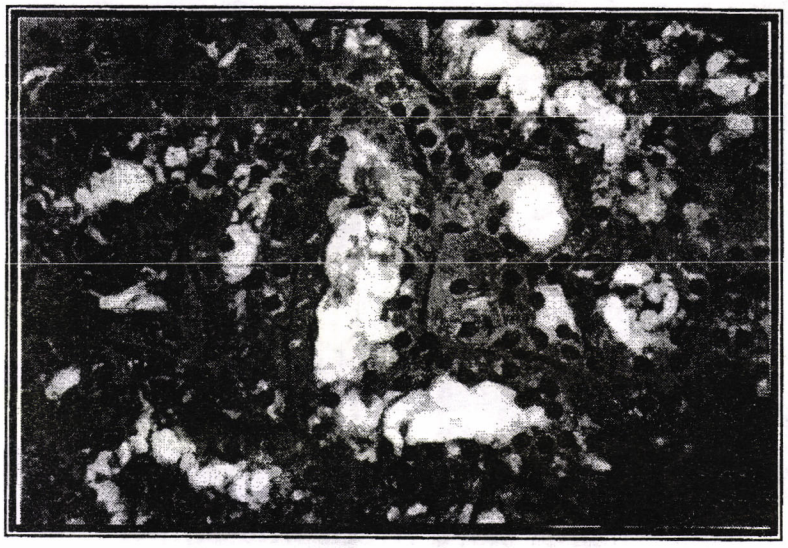

Fig. 6: Cloudy swelling of the renal tubules with narrow of the lumen in.

Harris hematoxylin and Eosin. Mag. 500X

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