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# SELF RECOVERY FROM MERCURY CHLORIDE INTOXICATION IN RATS

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## *ABSTRACT*

The injection of 1 mg/Kg b.wt of mercuric chloride produced an increase of total protein, $Na^+$ and $K^+$ content in serum. There was a decrease in serum total lipid and calcium. In addition there is an inhibition of total ATPase activity in kidney of the treated rats. The data also showed a deceased total lipid and an increase in water content in kidney after 2 weeks of mercury exposure. When mercury injection was stopped and the animals were left for another 2 weeks most of the studied parameters showed a slight recovery from mercury poisoning and the values tend to reach the control one.

## INTRODUCTION

Mercury is a heavy metal known to be toxic substance for various animals including man. It is reported that mercury influence large number of memberane functions due to its high affinity of binding to the membrane sulphydryl groups, with effects such the depression of active transport and enhanced passive permeability (Valle and Ulmer 1972 and El-Missiry, 1986).

Many reporters have shown that in vitro and in vivo, exposure to mercury can produce lipid peroxidation (Utley et al., 1967 and Taylor et al., 1973), inhibit Na-K ATP ase (Othman et al., 1992), change water permeability across biological membrranes (El-Missiry, 1986) and increase plasma osmolarity (Yamamoto and Suzuki, 1982).

Most of the previous investigation suggested different agents to overcome the toxic effect of mercury (Yamamoto and Suzuki, 1982).

The aim of the present study is to show the normal body response when mercury intoxication was stopped after 2 weeks of mercury exposure.

## MATERIALS AND METHODS

Mals albino rats weighing about 120-150 g/animal, were used in the present study. The animals were kept under good ventilation and adequate stable diet. The animals were intraperitoneally injected with mercuric chloride dissolved in distilled water for two weeks at a dose level of 1 mg/kg body weight. (Valle and Ulmer 1972)

The animals were divided into theree groups.

1- Normal control group did not receive injection (group 1).

2- In the group 2, rats were injected intraperiteally with (1mg/kg) mercuric chloride for two weeks.

3- In group 3, the rats were treated similar to group 2 then 2 left without injection for another two weeks

Animals were sacrified, the kidney were excised, rinside and homogenized in tris buffer for 5 min. followed by centrifugation (5000

rpm) then supernatants were subjected for determinations, Blood samples were collected and centrifuged for 15 min at (5000 rpm).

The total protein determination was carried out using the method of Lowry et al. (1951). The total ATP ase activity was assayed by the method of skou (1963). The flame photometer was used for determination of sodium, potassium and calcium concentrations in serum. The method of Sakamoto (1985) was adopted to determine the total lipids in serum and kidney. the water content in kidney was estimated from the difference between wet and dry weights. Statisticall analysis was perfomed according to Erricker (1971)

## RESULTS

It is observed that the total protein content was increased in serum of $Hg\ Cl_2$ treated rats (Table I). On the other hand the total lipid content in both serum and kidney were significantly decreased in the same animals (group2). Mercuric chloride injection for 2 weeks induced an inhibition of kiduney total ATP ase activity (Table II). Serum sodium and potassium content showed a significant increase after mercuric chloride injection, while calcium concentrations showed a significant decrease as compared with group 1.

Water content showed a significant increase after $HgCl_2$ injection for two weeks (table II). In group 3 which treated with $HgCl_2$ (1 mg/kg b.wt) for 2 weeks and left for more 2 weeks without $HgCl_2$ showed slight recovery from mercury poisoning. It is observed that serum protein was significanty higher than the control and $HgCl_2$ treated group (group 2). The serum total lipid, $Na^+$and $K^+$in group (3) were lower than mercury treated rat (group 2) but $Na^+$ and

$K^+$concentration still higher than the control. The calcium level was increased in group 3 when compared with group 2 and showed a close value to the control animal (group 1) after two weeks of mercury elemination.

When mercury injection were stopped, it was observed an increase in total ATP ase activity after 2 weeks. The total lipid and water contents in kidney (Table II) of group (3) showed recovery tendancy to the normal value after 2 weeks when mercury intoxication was stopped.

## DISCUSSION

**Effect of mercury chloride:**

The total protein, $Na^+$ and $K^+$ serum were increased after two weeks of mercuric chloride injection (1 mg/kg b.wt.). These results are in agreement with the published data of Yamamoto and Suzuki (1982) and Othman et al. (1992). They registered an elevation of $Na^+$ and $K^+$ concentration in serum of mice and rats after 2 & 3 weeks of mercury intoxication. The elevation of these parameters meight be the reason of the elevated plasma osmolarity reported by Stroo and Hook (1977). It also observed that water content was incnreased in kidney of $HgCl_2$ treated rats (group 2) when compared with the control animals. The recorded changes in $Na^+$ and $K^+$ and water suggested that the renal concentrating ability might be affected by mercury poisoning. On the other hand the changes in kidney water content and serum electrolytes could be explained by the inhibition of total ATPase activity reported in this study (Yoshida, 1983).The cause of enzyme activity inhibition might be explained by the fact that the inhibition occurred through the

binding of the enzyme protein group with mercury resulting in the formation of mercaptid bonds (Goodman and Gillman, 1985).

In the present study, serum total lipid was decreased after 2 weeks of $HgCl_2$ intoxication. Many reports have shown that exposure to mercury can produce lipid peroxidation (Taylor et al., 1973). Sakamoto (1985) reported that mercury decreases polyunsaturated fatty acids through lipid peroxidation process.

It is also observed that serum calcium content was decreased after $HgCl_2$ injection (1 mg/kg b.wt.). This finding might be due to excessive loss of calcium through renal tubules which damaged by the injection of $HgCl_2$ for 2 weeks (Foulkes, 1983).

**Recovery of mercury intoxication:**

The present study indicates that there was slight recovery in the studied parameters in group 3 when compared with group 2. In the course of chronic poisoning, a detoxification mechanism was developed at various levels. The production of metalothionine which is a mercury binding protein becomes intensified (Cember et al., 1968). This protein content might be provide suitable condition for restoration of the activity of total ATPase in kidney.

In conclusion, there was some revovery after two weeks of stopping mercury exposure as evidenced by increased total ATPase activity in kidney, $Na^+$, $K^+$ and $Ca^{2+}$ contents in serum as well as increased serum total protien.

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Table I. Changes in serum parameters in control and treated groups.

| | Group 1 | Group 2 | Group 3 |
|---|---|---|---|
| Total protein (g/100 ml) | 6.9±0.01 | 7.97±0.55* | 9.54±0.6* |
| Total lipid (mg/100 ml) | 530±6.1 | 442.3±17.5* | 302.95±11.9* |
| $Na^+$ (mg/100 ml) | 452±20.7 | 561.8±33.7* | 518.89±38.8* |
| $K^+$ (mg/100 ml) | 29.97±0.7 | 38.52±2.5* | 32.76±4.61 |
| $Ca^{2+}$ (mg/100 ml) | 12.73±0.4 | 8.9±3.1* | 11.16±1.9 |

Table II. Chanes in kidney parameters in control and treated groups.

| | Group 1 | Group 2 | Group 3 |
|---|---|---|---|
| ATPase µmole Pi/min/g fresh tissue | 9.16±0.4 | 3.87±1.07* | 5.65±0.7* |
| Total lipid mg/g fresh tissue | 202.31±23.1 | 137.89±12.31* | 169.73±13.91* |
| Water content mg/g fresh tissue | 635.53±4.3 | 826.15±6.4* | 780.37±3.7* |

* Significant at $P<0.05$

# الشفاء الذاتى من التسمم بكلوريد الزئبق فى الفئران

عزة اسماعيل عثمان

قسم علم الحيوان- كلية العلوم - جامعة المنصورة

تم دراسة تأثير حقن كلوريد الزئبق بجرعة ١مجم/ كجم من وزن الجسم وأشارت النتائج الى حدوث زيادة فى البروتين الكلى ومحتوى الصوديوم والبوتاسيوم فى المصل كما لوحظ نقص فى الدهن الكلى والكالسيوم فى المصل أيضا وبالاضافة الى ذلك لوحظ انخفاض فى نشاط إنزيم ثلاثى الفوسفات الكلى ATPase الكلى فى الفئران المحقونة. كما سجلت النتائج أيضا نقص فى محتوى الدهن وزيادة فى محتوى الماء فى الكلية بعد أسبوعين من حقن كلوريد الزئبق. وعند ايقاف حقن كلوريد الزئبق وترك الحيوانات بدون حقن لمدة أسبوعين لاعطائها فرصة للاستشفاء الذاتى، لوحظ تحسن طفيف فى معظم المعايير المدروسة.