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Short Communication

Assessment of haematotoxic potential of mercuric chloride in rat

Kanhiya Mahour* and Prabhu N. Saxena

Toxicology Laboratory, Department of Zoology, School of Life Sciences, Khandari Campus, Dr. B.R. Ambedkar University, Agra - 282 002, India

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Abstract: *The blood is an important liquid connective tissue flow in body and performs the role of distribution of oxygen to various tissues, taken out carbon dioxide and maintains the health status of an organism. Any change in the blood components can cause adverse effects on the body. The effect of mercuric chloride has been evaluated on blood in albino rats (Rattus norvegicus). The albino rats were treated with mercuric chloride 0.926 mg kg^{-1} body wt. for acute (1 day) and 0.044 mg kg^{-1} body wt. for sub-acute (7, 14 and 21 day) sets after calculating LD_{50} (9.26 mg kg^{-1} body wt.). Major changes have been observed in the form of enhanced clotting time (CT) and bleeding time (BT) due to toxic effect of mercuric chloride on haemopoietic system along with decrease in the total erythrocyte count (TEC) and haemoglobin concentration (Hb. conc.). The changes in erythrocyte count and haemoglobin concentration have been correlated with cytotoxic effect of mercuric chloride on erythropoiesis. However, the intoxication of mercuric chloride on total leukocyte count (TLC) and erythrocyte sedimentation rate (ESR) has been observed to be significantly increased after acute and sub-acute treatments due to leucocytosis and rouleux formation. Moreover, the present observations highlight dose dependent toxicity.*

Key word: *Total erythrocyte count, Erythrocyte sendimentation rate, Wintrobe's tube, Neubauer haemocytometer*
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Introduction

The increase in the pollution is a major and global problem. This is due to the use of toxic chemicals or xenobiotic substances or by certain synthetic compounds such as heavy metallic compounds (Foulkes, 1990; Jagadeesan and Pillai, 2007). Of these heavy metallic compounds few reveal potential effects. They reach the environment after their liberation though industries (Migliore, 1999). Metallic compounds on land and water pose potential health hazard not only to livestock and wild life but also to fishes, birds, mammals and even to human beings.

Heavy metallic compounds have emerged as a major class of industrial waste product (Budavari, 1996). They can be produced synthetically in laboratories from their derivatives. The most commonly used synthetic heavy metallic compounds are mercuric chloride, mercurous chloride and lead acetate of which mercuric chloride is most dangerous as it produces neurotoxicity, hepato-toxicity and nephrotoxicity in animals (Kavitha and Jagadeesan, 2006).

In the present investigation an effort has been made to explore the effect of a synthetic heavy metallic compound, mercuric chloride on haematological parameters (clotting time, bleeding time, total erythrocyte count, total leukocyte count, haemoglobin concentration and erythrocyte sedimentation rate), as blood is an important liquid connective tissue participating in all vital functions in the individuals body.

Materials and Methods

Albino rats (*Rattus norvegicus)* weighing 120-130 g with an average of 125±2.36 g from an inbred colony representing both the sexes were selected for experimentation. The rats were kept in polypropylene cages at 20±5°C temperature, 50±5% relative humidity and 10 hr day^{-1} photoperiod entire experiment. Rats were fed on pellet procured from M/s Lipton India Ltd., Kolkota and water was provided *ad libitum.*

Forty albino rats were divided into two sets of 20 each. The first set of 20 rats included four treatment groups for acute (1 day) and sub-acute (7, 14 and 21 days) studies for mercuric chloride with 5 rats in each groups. The second set of 20 rats served as control having four groups *viz.* acute (1 day) and sub-acute (7, 14 and 21 days) with 5 rats in each groups. The acute and sub-acute doses for mercuric chloride were 0.926 mg kg^{-1} body wt. (LD_{50} /10) and 0.044 mg kg^{-1} body wt. (LD_{50}/210) respectively. Rats were taken out after 1, 7, 14 and 21 days from control (served with distilled water) and treated sets and were anaesthetized by chloroform. The blood was collected directly form cardiac puncture by sterilized needles and stored in glass vials having anticoagulant (EDTA). Clotting time (CT) and bleeding time (BT) were estimated by Duke's method as outlined by Wintrobe *et al*. (1985), Total erythrocyte count (TEC) and total leukocyte count (TLC) were conducted by using the improved Neubauer haematocytometer (Dacie and Lewis, 1975), while erythrocyte sedimentation rate (ESR) and haemoglobin concentration estimated by Sahli's and Wintrobe's method (Wintrobe *et al.*, 1985)respectively.

Statistical significance between treated and control values were also calculated according to student 't' test (Fischer, 1950).

Results and Discussion

Mercuric chloride showed dose dependent toxicity. Agrawal and Chaurasia (1991), Sarkar *et al*. (1992) have also revealed

* **Corresponding author:** kris_mathura@yahoo.com

Table - 1: Effect of sub lethal doses of mercuric chloride on haematological parameters (Mean ± SE) after acute (1 day) and sub acute (7, 14 and 21 days) treatment

Parameters	Control	Mercuric chloride			
		Acute (0.926)	Sub acute		
		1 day	7 days	14 days	21 days
BT (sec.)	44.40±2.11*	83.33±2.17[a]	53.66±3.92[b]	46.33±1.20[c]	43.66±2.02[c]
CT (sec)	73.24±1.72*	121.33±2.92[c]	92.6±1.45[b]	82.66±1.45[a]	60.33±1.80[c]
TEC (10^6 mm^{-3})	5.72±0.02*	5.57±0.01[b]	5.69±0.02[c]	5.62±0.02[c]	4.99±0.03[a]
TLC ($10^3 mm^{-3}$)	8.40±0.07*	9.20±0.12[a]	8.53±0.09[c]	9.50±0.08[c]	9.83±0.06[c]
ESR (mm hr^{-1})	3.91±0.13*	3.95±0.31[b]	4.72±0.24[b]	4.29±0.27[b]	5.52±0.33[c]
Hb (g dl^{-1})	14.62±0.11*	14.63±0.12[d]	13.66±0.30[b]	13.33±0.12[b]	13.93±0.09[c]

BT = Bleeding time, CT = Clotting time, TEC = Total erythrocyte count, TLC = Total leucocyte count, Hb = Haemoglobin. The values are significant, a = $p<0.001$, b = $p<0.01$, c = $p<0.05$, d = $p>0.05$, * Mean value of 20 rats

similar dose-dependent toxicity in albino rats following mercuric chloride and sodium arsenite intoxication respectively.

Further, albino rats show significant ($p<0.05$) increase in clotting time as well as in bleeding time after mercuric chloride intoxication. Moreover, the toxicity of mercuric chloride leads to a significant ($p<0.05$) decrease in the total erythrocyte count (TEC) and haemoglobin concentration (Hb. conc.) after acute (1day) and sub-acute (7, 14 and 21 days) treatment.

However, total leucocyte count (TLC) and erythrocyte sedimentation rate (ESR) have been significantly ($p<0.01$) increased after intoxication of mercuric chloride after acute and sub-acute treatment (Table 1). The increase in bleeding time (BT) and clotting time (CT) may probably be due to the toxic effect of mercuric chloride on haemopoietic system which results in destruction and decrease in the level of platelet formation (Sarkar *et al*., 1992). Increase in the bleeding and clotting time could be due to some liver disorder because the important clotting factors such as fibrinogen and prothrombin are synthesized in the liver.

The decrease in the total erythrocyte count (TEC) may be due to the cytotoxic effect of heavy metallic compounds on the erythropoietic tissue, the bone marrow. Such a disturbance in bone marrow leads to alteration of cell cycle and reduction in erythropoeisis (Nunes *et al*., 2001; Tariq, 2007; Sharma *et al*., 2007).

Enhancement in the total leucocyte count (TLC) following mercuric chloride intoxication could be possible due to leucocytosis as leucocytosis is an outcome of proliferation of haemopoietic cells leading to progressive infiltration in peripheral blood (Tariq, 2007; Sharma *et al*., 2007). Mercuric chloride increases the erythrocyte sendimentation rate (ESR) in both acute and sub-acute sets. This increase is due to the decreased total erythrocyte count (TEC) as total erythrocyte count depends on the rouleux formation of erythrocytes. Further, the rouleux formation is an indication of increase in the density of its mass which along with reduced erythrocyte count, is responsible for increased erythrocyte sedimentation rate (Agrawal and Chaurasia, 1989).

However, reduction in haemoglobin concentration (Hb. conc.) may probably be due to production of reactive oxygen species under the influence of mercuric chloride, which results in destruction of the red blood cell membrane and its function (Tariq, 2007).

Hence, it can be concluded that the above alterations in blood strength could be a positive effect of mercuric chloride in a mammalian species.

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