Nephrotoxic and Hepatotoxic Effects of Chromium Compounds in Rats

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The nephrotoxic, hepatotoxic and cardiotoxic actions of hexavalent chromium compounds (Kaufman et al. 1970; Schubert et al. 1970; Evan and Dail 1974), as well as their effects on lung, blood and circulation may contribute to the fatal outcome of chromium intoxication (Langard 1978).

Although trivalent chromium have been regarded as relatively biologically inert (Baetjer et al. 1974), there are a few salts of chromium III like chromite ore roast, chromic acetate, and others that have been found to be carcinogenic when inhaled, ingested or brought in contact with the tissues (Hueper and Payne 1962; Steffee and Baetjer 1965).

Sensitive persons and industry workers have been subjects of dermatitis, respiratory tract injuries and digestive ulcers due to chromium compounds (Hagendoer, Furon 1981).

Tandon et al. (1978), studied the comparative toxicity of two forms of chromium, trivalent and hexavalent, to which chromite miners, chromate workers or consumers of the products of this industry might be exposed. They have also studied the effects of these compounds in rabbits on the morphology of liver and on the levels of certain chemicals constituents of blood, in relation to the concentration of chromium.

In this work, we have studied the effect of trivalent and hexavalent chromium compounds on rats measuring the transaminases (GOT and GPT), urea and creatinine levels in serum of chromium poisoned animals at different times.

MATERIALS AND METHODS

80 Wistar albino rats from our laboratory colony weighing 230 ± 12 g. and maintained on 'ad libitum' standard pellets diet (Panlab) and water 'ad lib.', were used in the investigations.

The animals were divided into two groups: Group A comprising 50

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rats and Group B comprising 30 rats. 40 animals of Group A were administered intraperitoneally with 2 mg Cr/kg as chromium chloride (E.Merck) three times a week, and 24 rats of Group B were administered i.p., three times a week also, with 2 mg Cr/kg as sodium chromate (E.Merck). These compounds were dissolved in 1 ml of sodium chloride 0.9%. The pH of the injecting solution was raised to 6.5; and the dose was adjusted every week according to the weight of the animals. 10 rats of the Group A, and 6 rats of the Group B, used as control, received an equal volume of normal saline.

10 rats treated with chromium III were sacrificed after 15, 30, 45 and 60 days, whereas 6 rats treated with chromium VI were sacrificed after 15 and 30 days, both 24 h following the last injection. This period was allowed to enable excretion of the unbound chromium from the body (Tandon et al. 1979).

Liver and kidneys were removed and kept for macroscopic and microscopic observations. The blood was collected from the aorta artery in centrifugate tubes to obtain serum.

Transaminases (GOT and GPT) were determined by the method of Reitman and Frankel (1957); urea was determined according to Berthelot's equation; and creatinine was determined according to Jaffé's reaction, in serum and by means of a Spectronic 2000 Spectrophotometer (B&L).

A part of the medial lobe of the liver, and the kidneys of both, experimental and control animals, were fixed in 10% neutral formalin. After routine histological proceeding, parafin section were cut at 5 μm and stained with hematoxilin-eosin for histological observations.

RESULTS AND DISCUSSION

There was no mortality among the rats treated with trivalent chromium during the experimental period (15, 30, 45 and 60 days). The animals apparently remained healthy throughout the course of the experiments.

The liver, under a gross examination, was found to be slightly congested in experimental animals after 45 and 60 days of treatment, whereas the kidneys appeared completely normal during the experimental period.

The liver and kidneys of control animals showed normal architecture. After 15 days of treatment no changes were observed in the hepatic architecture when compared to the control animals.

Enlargement of the proximal tubule of the kidney with a flattening of the epithelial lining, was observed. Fine vacuolation of the proximal tubule cells was observed at day 15.

The first alteration was observed in liver at day 30 consisting