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Histopathological on Kidney of Male Mice Orally Intoxicated With Nickel Chloride

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ABSTRACT

Kidneys play an important role in control and regulation of homeostasis. It is also known that many heavy metals are nephrotoxic as kidney concentrates them before excretion. In order to assess the nephrotoxic effects of nickel chloride, the present work was under taken to observe histopathological changes in kidney of mice by oral administration of different doses of three nickel salts ($NiCl_2$). Histopathological studies with light microscopy were made on the kidney of control and experimental groups of mice. Histopathologically, the density of Bowman's capsules and tubules decreased as compared to control. The Bowman's capsules were damaged and contracted badly. The pacts (Proximal convoluted tubules) showed more necrosis than dcts (Distal convoluted tubules) necrosis.

Introduction

The mammalian kidney is an extremely complex organ, both anatomically and functionally, and plays an important role in the control and regulation of homeostasis. Nephrotoxic effects in animals had already been studied after exposure to very high concentrations of nickel. Nephrotoxicity was manifested by structural, glomerular and tubular alterations, proteinuria, enzymuria[1-4]. Some workers have also studied the effect of nickel salts. e.g. nickel subsulfide[5, 6], nickel sulphate and nickel chloride[6]. Nephrotoxicity seen in rats following exposure to Nickel carbonyl revealed that 100 mgL^{-1} oral exposure to soluble nickel either induces changes of glomerular permeability in female and possibly in male rats, or enhances the normal age-related glomerular nephritis lesions of ageing rats[7, 8].Hence the present studies have been carried out to see the toxicity on kidney of male mice by light techniques.

Material and Methods

Adult male mice, weighing 28-32 gm of Balb/, were orally administered different doses of nickel Chloride daily for 21 days through gavages orally 6 mg/kg b.wt., and 15 mg/kg b .wt of $Nicl_2$. The animals were divided into 4 groups each group having 5 mice (one control group on normal diet and water). The kidney from all these groups was cut into two pieces and put in 0.9% physiological saline and fixation was done in Bouin . The tissues were dehydrated in different grades of alcohol, cleared in benzene and embedded in paraffin wax (60-62^oC). Sections of (0.7) thickness were cut on microtome and stained in haematoxylin/eosin (H/E).

Results

The intake of feed and water by treated mice reduced as compared to control. Moreover, the decrease was dose dependent. Each nephron of control kidney has a spherical expansion known as Bowman's capsule enclosing a tuft of capillaries, the glomerulus. Bowman's capsule and the glomerulus together form the renal or malpighian capsule (Figure.1). With (6 mg/kg b.wt) dose, the spaces have been observed. The density of Bowman's capsules and tubules decreased as compared to control (Figure. 2). With (15 mg/kg b.wt) dose the spaces increased between the tubules. Some glomeruli were damaged. The outer wall of the Bowman's capsule was also damaged. The lumen of some of pcts was blocked and the boundaries of cells disappeared. The cells some of distal convoluted tubules also showed necrosis .. The wide spaces were observed. The glomeruli contracted and wide space was formed around glomerulus in Bowman's capsules (Figure.3).

Discussion

Nephrotoxic effects in animals had already been studied after exposure to very high concentrations of nickel. Nephrotoxicity was manifested by structural, glomerular and tubular alterations, proteinuria and enzymuria[4]. Metals can enter proximal tubular cells by endocytosis following the binding of the metal itself or a metalloprotein complex to the brush border membrane[9]. Once inside the cell, the metal can be released from the protein metal complex by lysosomal degradation. Diamond[10] have indicated that some metals can enter renal cells as glutathione-derived conjugates by specific transport systems located on both brush border and basolateral membranes. The intracellular distribution of the metal then depend on the presence of various high-affinity binding sites or sinks within the cell [11-13]. Low doses of a number of heavy metals produce a similar response, e.g. leakage of glucose and amino acids in the urine and diuresis. If the dose of metal is increased, the renal tubular necrosis occurs, which can lead to renal shutdown, a marked elevation in blood and ultimately the death of the animal. The histological pattern of injury is one of necrotic proximal tubules with of the tubular lumen which contains protein. This necrosis is thought to be due to a combination of ischaemia, secondary to vasoconstriction and a direct cytotoxic action of heavy metal[14-16]. Effects of nickel on kidney function, including tubular and glomerular lesions, have been reported by several workers[3,17]. Intramuscular injection of the insoluble compound like nickel subsulfide caused acute kidney damage in mice[5]. The binding of nickel to glomerular basement membrane has been investigated[18].

The observations of the above workers are in conformity with most of the present observations. It can be concluded that high doses cause severe nephrotoxicity as the histoarchitecture

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of glomeruli and proximal convoluted tubules shows necrosis and thus the nickel chloride will affect the homeostatic role of the kidney.

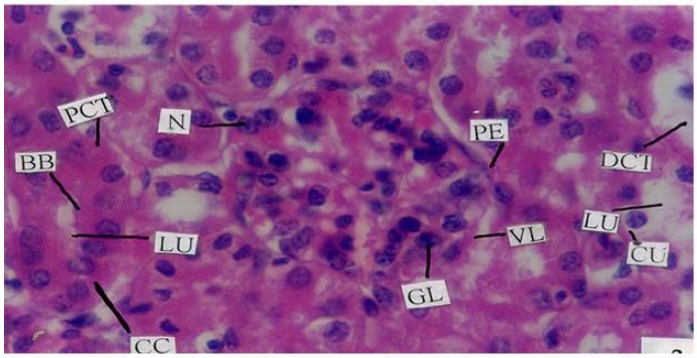

Figure 1. Transverse section of kidney of mice, stained with Haematoxylin / Eosin. (Magnification 400 X). Showing a tuft of capillaries forming glomerulus (GL), visceral layer (VL) and parietal layer (PE) of Bowman's capsule. In proximal convoluted tubules (pct), the lumen (LU) is surrounded by brush border (BB), columnar cells (CC) with nuclei (N). In distal convoluted tubules (Dct), the lumen is not bounded by brush border, the cuboidal cells (CU) are on luminal side (control)

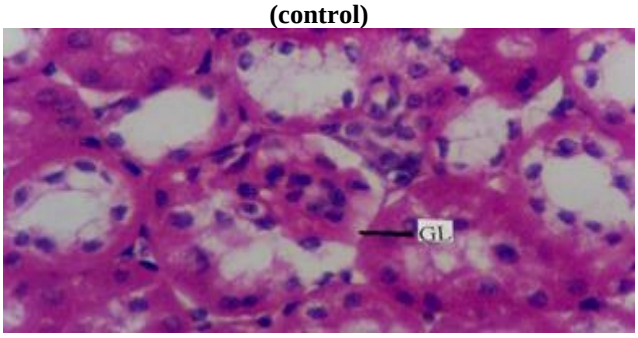

Figure 2. Contracted glomerulus and blocked lumen of pcts due to necrosis with 6 mg/kg b. wt. of $NiCl_2$

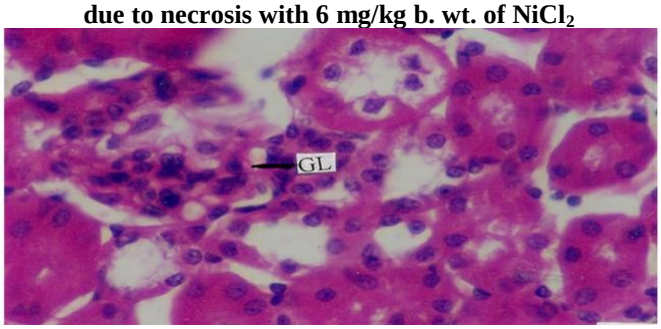

Figure 3. Contracted glomerulus, increased space with glomerulus and Bowman's capsule with 15 mg/kg b .wt of $NiCl_2$

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