HISTOLOGICAL STUDIES OF BRAIN, LIVER AND KIDNEY IN LEAD INDUCED CHICK EMBRYOS, A STUDY IN REGARDS TO ENVIRONMENTAL EFFECTS.

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INTRODUCTION :

Lead is one of the toxic heavy metals. It is widely used in a variety of modern industries for its valuable properties. But the importance of lead as an environmental pollutant can not be overstressed. The soil lead enters the ground water and ultimately reaches drinking water to be consumed by animals. The concentration of lead in air near heavy traffic may be twenty times more than that in rural areas. Uses of grass, bordering the roads carrying great deal of traffic for livestock feeding may result in deleterious consequences from nutritional point of view. Generally, heavy metals are known to have profound physiological effects even with trace quantities. Through various ways after entering into the biological system how the lead affect the different vital organs has been tried to explore in the present experiment.

MATERIALS AND METHOD :

Present study was made with 250 fertile white leghorn eggs; these were equally divided into five groups. Group I was kept as control. Group II was injected with 1 mg lead nitrate/egg, likewise group III with 2 mg. lead nitrate/egg, group IV with 1 mg. lead acetate/egg and group V with 2 mg lead acetate/egg was given. In all the lead treated groups, only a single dose of lead salt in 0.05 ml distilled water was injected into the

yolk sac on the tenth day of incubation. 50% control eggs were injected with 0.05 ml distilled water and rest were kept intact. All the incubated eggs of 5 groups opened on 19th day and sacrificed to collect the brain, liver and kidney. For the preparation of their slides, standard histological technique was followed.

RESULTS AND DISCUSSION :

RESULTS

Brain : When the brain was dissected out from the cranial vault, in general, it showed a gross reduction in size. Hydrocephalus and empty cranial cavities were observed in all the treated groups very frequently. There were haemorrhagic spots on the olfactory bulb of some treated brains, especially in lead nitrate treated groups.

The treated brain stem showed areas of haemorrhages often surrounded by oedematous tissue with dilated and congested blood vessels. Circumscribed areas with complete degeneration, containing little cellular elements were also frequently seen. These degenerated areas were surrounded by dense gliosis. In some fields, vacuolisation occured which showed a tendency towards coalescing with each other to form large cavities. This type of changes were very common in lead acetate treated groups. Oedema was found in all the treated brain stems with the characteristic conspicuous dilatations of blood vessels.

The cerebrum showed oedema and dilatation of blood vessels in the subcortical white matter and degenerating pyknotic cells in the cortex of most of the treated groups. Mild necrosis and glial cell proliferation, congestion of blood vessels were common in lead nitrate treated groups. The ventricles contained desquamated ependymal cells with heterophils and some mononuclear

cells. Haemorrhages in the cerebral cortex were common in the brain of lead nitrate treated groups. Necrosis, perivuscular cuffing and gliosis were also observed in lead acetate treated groups.

In the treated groups, the cerebellum showed oedema, which were marked higher in the cortex leading to separation of the internal granular zone from the superficial zone. Necrosis and gliosis were very common in lead nitrate treated groups. Haemorrhages in the cerebellar cortex and necrosis in the medulla were very common in lead acetate treated groups. In this group infiltration of mononuclear cells in the Virchow-Robin space was also observed.

Some regions of the cerebellum subcortical layers showed oedema and multiple vacuolisation showing a tendency to coalesce with each other and also dilated blood vessels amidst rich population of neuroglial cells.

Liver : In histological study, connective tissues covering capsule consisted of mainly collagen, elastic and a few reticular fibres. Smooth muscle fibres were also present. Connective tissue fibres extended from the capsule into the interlobular spaces and supported the vascular system and bile ducts. A fine network of reticular fibres surrounded the cells and sinusoids. The connective tissue supported the branches of the hepatic artery, portal vein and bile ductules. The hepatic lobule were organized around the central vein. The hepatic lobule was completely surrounded by connective tissue septa which was less conspicuous. The polyhedron shaped liver cells or hepatocytes had a centrally located spherical nucleus. Cytoplasm of the liver cells were mostly vacuolated. Cell boundaries were not well defined in most cases,

possibly due to vacuolation in the cell. Nucleus was vesicular and rounded in appearance.

In group II, cell boundaries were very distinct and there was no vacuolation in the cytoplasm of the liver cells. Widespread and diffused necrosis were found in some cases; where infiltration of lymphocytes and few plasma cells were present in hepatic parenchyma. Hepatic cords were disrupted due to necrosis. Sinusoids were disorganised and poorly distinguishable because of extensive infiltration of lymphocytes and plasma cells. Intranuclear inclusion bodies were not found by acid fuchsin stain. Cells were rounded instead of polyhedral in shape. In group III, necrosis of the liver cells was more and widespread in most cases. Most of the cells showed karyolysis and pyknosis except for the cells of centrilobular zone. Infiltration of lymphocytes and plasma cells were less.

In group IV, observations were more or less like group-II. Nuclei were swollen, vacuolated and larger in some cases. serous exudation and infiltration of mononuclear cells were also found. In group V, cells were almost normal but there was no vacuolation of cytoplasm and cellular infiltration or necrosis in most cases. Pyknosis and infiltration of mononuclear cells were also observed in some cases.

Kidney : In histomorphological study, it consisted of lobes with extensive convex surface and a smaller concave border in each lobe. It was enclosed by a thin Capsule consisted of connective tissue fibres; mostly collagen fibres and elastic fibres. The inner layer composed of loose connective tissue. The renal stroma was consisted essentially of loose connective tissue surrounding blood vessels. Nephron consisted of glomerular capsule, convoluted and straight portions of the

proximal tubule, the straight and convoluted portions of distal tubule. The cortical and medulla were more or less well defined. Zonation of the medullary part was less distinct.

In group II chick embryos, mild degenerative changes were noticed in proximal convoluted tubules. Necrosis of some proximal convoluted tubules were observed. The glomeruli were more or less normal with infiltration of few mononuclear cells. Presence of serous exudate in the intertubular space was also noticed. In group III, necrotic changes were prominent in convoluted tubules. Moderate infiltration of tubules with mononuclear cells in some Bowman's capsule were also noted. Necrotic tissues were found with predominant mononuclear cells. In group IV, fatty changes in some proximal convoluted tubules with desquamation of the lining epithelial cells of the convoluted tubules in few places were noted. Necrosis of some of the convoluted tubules were observed. Infiltration of the tubules were with mononuclear cells was noted. In group V, marked necrotic changes were noticed in the proximal and distal convoluted tubules with infiltration of mononuclear cells in the intertubular spaces. Proliferation of endothelial cells in some glomeruli was also observed. Bowman's spaces in few cases were filled with desquamated epithelial cells. Mild proliferation of connective tissues in the intertubular space was also noted in some embryos.

DISCUSSIONS

Brain : The treated brain stem and cerebrum showed areas of haemorrhages, often surrounded by oedematous tissues with dilated and congested blood vessels. The specific action of lead on cerebral blood vessels were also described by Pentschew and Garro (1966) and Blood et al (1983). Cerebral oedema, proliferation of glial cells, focal necrosis and neural degeneration in the present observation are in accordance with the report of Goyer and Rhyne (1973). Involvement of gray matter in both cerebrum and cerebellum tallies with the previous findings of Goyer and Rhyne (1973) and Gilman et al (1980). Vasodilatation, necrosis of vascular endothelium, vacuolation and necrotic changes in the treated brains are also similar to the previous reports by Hatch (1982) and Jones and Hunt (1983).

Severe degenerative changes of brain in case of group IV and V may be due to the higher concentration of organic lead in brain than that of inorganic lead (Swinyard et al, 1983). Desquamation of ependymal cells into the ventricles and infiltrations of heterophils and mononuclear cells are also a part of the degenerative changes observed in the present investigation.

Liver : In histological investigation necrosis and degenerative changes of the hepatocytes of lead induced chick embryos are in accordance with the earlier reports of Hatch (1982) and Madej et al (1988). But intranuclear inclusion bodies within the hepatic cells were not found in the present study, which was reported by Goyer and Rhyne (1973), Gilman et al (1980)

and Jones and Hunt (1988) on higher exposure of lead. On the contrary, inflitration of mononuclear cells within the hepatic parenchyma was observed. Karyolysis and pyknosis of cells were noticed only in case of group III, where higher doses of lead nitrate was induced. Besides necrosis and infiltration of mononuclear cells in case of lead acetate, swellen, vacuolated and larger nuclei and serous exudation were noticed in some areas of the hepatic parenchyma. The variation of changes in cells noticed may be due to the dose and toxicity of the lead acetate as compared to lead nitrate.

Kidney : Degenerative changes in tubular epithelium after treatment with lead compounds was also reported by Goyer and Rhyne (1973), Hatch (1982) and Jones and Hunt (1983). However inclusion bodies in tubular epithelium was not observed which was mostly present in large exposure of lead (Goyer and Rhyne, 1973). They also reported that minor changes of the kidney tissues are reversible. Gilman et al (1980), described that inorganic lead was distributed initially in the soft tissues, particularly in the tubular epithelium of the kidney. Infiltrations of mononuclear cells, serous exudate and haemorrhages in the intertubular space were mostly present in the lead nitrate treated groups. Whereas in lead acetate treated groups, fatty changes in proximal convoluted tubules with desquamation of the lining epithelium and proliferation of endothelial cells of glomeruli were observed. The severe pathological changes in the latter group might be due to the higher toxicity effect of lead acetate than that of lead nitrate. Tubular dilatation and fibrosis was not noticed in the present investigation which was reported by Jones and Hunt (1983) in chronic cases.

CONCLUSION :

In the present investigation it is found that both the lead compounds are detrimental to the vital organs of the body. By any means if such heavy metal entered through any exposure within the body system it may causes severe damage to the tissues of vital organs. It is also found that lead acetate is more lethal than the lead nitrate.

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