

Neurohistological Effects of Lead on Medulla of Adult Albino Rat

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ABSTRACT

LEAD is toxic to every organ of body, including central nervous system. This study is aimed to observe the histopathological changes in the medulla of rat induced by oral administration of lead compound in adult albino rats. Total number of 20 adult albino rats of either sex were included in the present study, consisting of equal numbers in both control and experimental groups. Experimental group received 4% aqueous lead acetate orally for 15 days, then animals of both groups were anaesthetized with ether and perfused with 10% formalin. Medulla was dissected. 10 μ thick sections were obtained and were stained with Glees Silver stain. Under light microscope, medulla from experimental group revealed not much conspicuous changes except for comparative lightly stained fibers and a little swollen tract areas. It was concluded that lead has toxic effects on the central nervous system including medulla which may explain the clinical manifestation of lead neurotoxicity.

KEYWORDS : Albino rats, Medulla, Lead acetate, Neurotoxicity

Introduction

Exposure of lead can take place more through inhalation of dust, vapours, fumes or ingestion of contaminated foods and drinks. It is capable of causing toxic effects at any level of exposure. In the brain, its most severe toxic effects were found to be on cerebellum (1). Plumbism means toxic effects of lead on the body, which on the central nervous system manifests as encephalopathy that is associated with focal cortical necrosis. Its clinical manifestation includes headache, twitching, convulsions, incoordination, tremor, paralysis, coma and death (2). Dendritic alterations of cerebellar Purkinje neurons in postnatally lead-exposed kittens has been reported (3) and decrease in maximum width of the hippocampus (4) have been noted. Symmetrical spongiform changes, bilaterally, in the roof nuclei of cerebellum have also been reported in the dogs exposed to orally fed lead (5) as well as bilaterally symmetrical areas of vacuole formation were noted at the tips of the cortical gyri (6). Cadmium, another heavy metal has been reported to induce anosmia (7) and in still another study cadmium inhalation was reported to affect olfactory bulb and contribute to olfactory dysfunction (8). Zinc gluconate trihydrate was reported to induce cellular and tissue damages to olfactory neuroepithelium and to olfactory bulb mitral cells in rats (9). Effect of Chronic administration of lead (Pb) on social behavior of male albino rats (10) The aim of present study was to see the effect of lead on the histology of medulla which may explain the clinical signs and symptoms following lead intoxication.

Material and Method

Total number of 20 adult albino rats (10 male and 10 female) weighing approximately 120 g were used in the present study. 10 rats with equal number of either sex were treated with 4% lead acetate while the remaining 10 rats (5 male and 5 female) served as control group and were given distilled water and did not receive any active compound. The concentration of lead acetate was ascertained after a careful trial so as to find a maximum survival to 15 to 20 days. Then, rats were anaesthetized with ether and perfused with buffered 10% formalin. Brain was dissected out, meninges removed and 3 mm thick coronally sliced pieces were cut from medulla and processed for paraffin embedding. Then, 10 μ thick sections were cut with rotary microtome. These sections were stained with Glees Silver stain and observed under the light microscope.

Observations

Medulla of (control group) shows well stained and well defined fibers and tracts with proper orientation in high power (Figure 1). On examination, under the light microscope, the medulla of the treated group showed not much conspicuous changes except for comparative lightly stained fibers and a little swollen tract areas (Figure 2)

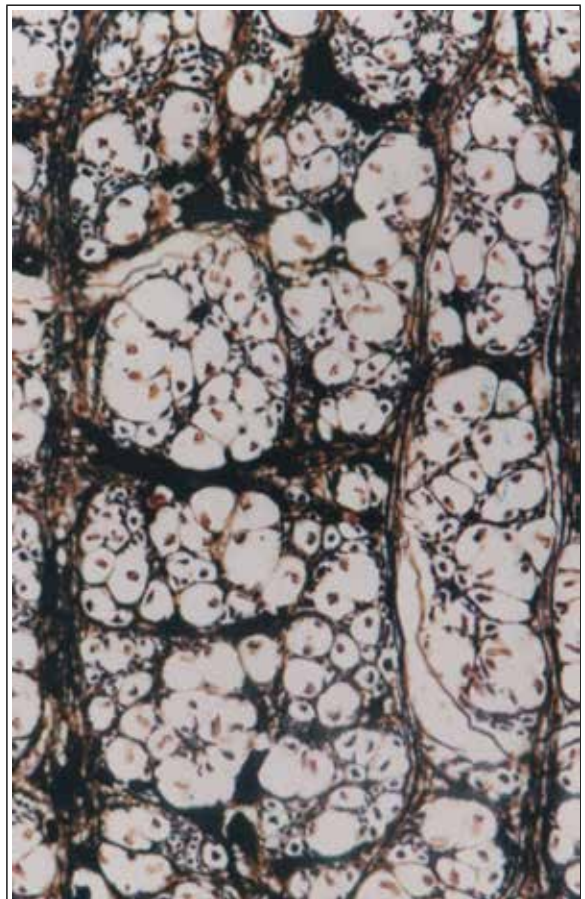


Fig -1 Medulla of (control group) shows well stained and well defined fibers and tracts with proper orientation in high power (Glees Silver Stain)

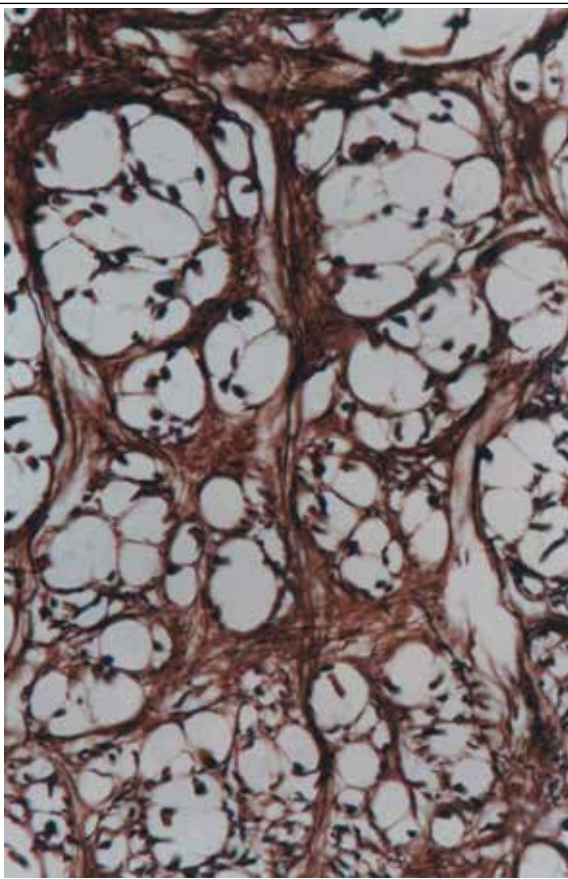


Fig -2 medulla (of experimental group) showed not much conspicuous changes except for comparative lightly stained fibers and a little swollen tract areas(Glees Silver Stain)

Discussion

Histological findings in the present study were suggestive of neurotoxic and degenerative effects of lead on the medulla. These findings are in partial agreement with other neurohistological studies. In one of the studies, vascular changes in addition to encephalopathic effects of lead mediated directly at the neuronal level, was reported, when adult guinea pig was exposed to Lead carbonate (11). Some other workers have reported hypertrophy of vascular pericytes(12). Implantation of lead pellets in the forebrain of rat resulted in vascular changes in addition to parenchymal necrosis and spongiosis in the

hypothalamus(13). Histological study of many parts of the brain e.g. cerebral cortex, cerebellum, choroid plexus and corpus striatum after toxic lead exposure showed cerebellum to be most severely affected(14). Additionally in this study(14) haemorrhages noted along with damage to Purkinje cell layers and oedema in the granule cell layer. Altered myelination and axonal integrity in adults with childhood lead exposure has been reported by using diffusion tensor imaging study (18). The histological findings observed in our study confirmed the toxicity of medulla following lead poisoning and correlated very well with the histological findings of the other studies.

Conclusion

Exposure of rat to lead for 15 days produces demonstrable microscopic alterations in the medulla.

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