ORIGINAL ARTICLE

Morphological Changes in Cerebellum of Albino Mice by giving lead: An experimental study

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ABSTRACT

Effects of lead on brain morphology of albino mice were seen in this study. Sixty albino mice were divided into five groups. Group 0 was scarified after first week for baseline morphology. Group I, (normal control) was fed on synthetic diet, group II, III and IV were given lead acetate 2 mg, 4 mg and 8 mg/kg/day respectively for 60 days. H&E and Rhodizonate methods were performed for histological examination. Cerebellum of albino mice revealed increased oedema, congestion and neuronal changes (pyknosis) in group II. Group III and IV showed moderate changes in all the parameters of albino mice cerebellum. Rhodizonate stain did not show lead deposition in mice cerebellum at these blood lead levels. Low levels of lead toxicity showed brain changes due to its sensitivity.

Key words: Cerebellum, lead

INTRODUCTION

Lead is soft bluish gray metal, astringent in character, used since ancient times because of its useful properties, such as low melting point, pliability and resistance to corrosion[1,2]. Lead exists only in small quantity in the earth crust. The principle lead ore is galena and this is usually associated with the sulfides of silver, copper, arsenic, antimony, bismuth and tin. Other common ores are carbonates and sulfates[3].

An average human body contains about 120 mg of lead, which is mainly present in the skeleton and smaller amount in the hair, blood, aorta, kidney, liver and spleen. An adult ingest about 300 µg of lead via food and water per day. Atmospheric intake in urban area is about 14 µg per day[4].

In a study performed on rats, it is noted that developing nervous system is preferentially vulnerable to lead exposure with alterations in neuronal and glial cells of brain[5]. The behavioural complex stereotype responses such as rearing, preening, scratching and biting were observed in an open - field situation in rats ingesting 2% lead acetate in drinking water for a period of 30 days[6].

METHODOLOGY

Sixty albino mice were selected for this study. At zero week, twelve mice were dissected to provide base line control. Group-I was control group. Groups II, III and IV were given lead acetate in deionized water for sixty days with doses of 2,4 & 8mg/kg/day or .002, .004 and .008mg/gm/day respectively. The blood samples were taken by heart puncture and collected in a glass container having EDTA. After sampling, animals were anesthetized till death. Brains were exposed and dissected out.

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RESULTS

Blood lead levels and morphological changes of cerebellum in different groups (Table 1&2)

Table 1: Blood lead levels in control and experimental group at 60 days in cerebellum of albino mice

Groups	Mean±SD Value	Ranges	Total
I(Control)	0.217 ± 0.013	0.2– 0.236	12
II	0.247±0.019	0.226 – 0.278	12
III	0.410 ± 0.020	0.366 – 0.432	12`
IV	0.662 ± 0.024	0.626 – 0.691	12

Statistical Analysis: I vs II = p>0.05 (NS)
I vs III = P < 0.05 (S), I vs IV = P<0.01 (HS)
I=Synthetic diet, II=Mice with lead dose 2 mg/kg/day, III=Mice with lead dose 4mg/kg/day, IV=Mice with lead dose 8 mg/kg/day

Table 2: Changes in cerebellum of different groups

Microscopic Features	No. of animals with +ve changes			
	Group I	Group II	Group III	Group IV
Cerebellar oedema	0	08	12	12
Cerebellar necrosis	0	00	11	12
Astrocytic proliferation	0	00	11	12
Vascular changes endothelial proliferation congestion	 0 0	 00 11	 10 12	 11 12
Neuronal changes pyknosis	 0	 08	 10	 12

Group I=Synthetic Diet, II=Mice with lead dose 2 mg/kg/day III=Mice with lead dose 4 mg/kg/day, IV=Mice with lead dose 8 mg/kg/day

DISCUSSION

The biological limit value for blood lead in developing countries suggesting sub-clinical absorption is reported to be 20–40µg/dl. Whereas the values of 40–60µg/dl is an indicator of excessive lead absorption. Safety limits set by Bio science laboratories and centre for disease control (CDC) are 40µg/dl for adults and 30 µg/dl for children. The level of toxicity for early toxic effects in children have been lowered from 25µg/dl to 10µg/dl by CDC and there may not be any threshold concentration for lead toxicity[10,11].

Observations made in humans indicate that steady state blood lead concentrations are reached under relatively constant daily exposure conditions after 6–8 weeks[8]. The blood lead levels obtained in this study are comparable with current levels measured in general population[9]. The blood lead levels in different doses of lead were significantly increased when compared with controls. Doubling of blood lead levels between 2 and 4 mg/kg/day groups and failure to observe a similar increase between 4 and 8 mg/kg/day groups may be explained that blood lead levels are not linearly correlated with the dose administered[15]. The mechanisms responsible for lead absorption might get saturated if large single doses are administered. It is in agreement with the study done by Viskocil et al (1995)[7] about cerebellum of mice following lead exposure.

The effects of lead toxicity are dose dependent; prolonged low level lead exposure can initiate the brain lesions, but higher dose and prolonged period of exposure is necessary for significant Irreversible changes to occur and the blood lead level should be >66 µg/dl to have marked changes.

GROUP II (Lead dose 2mg/kg/day): The microscopic findings in cerebellum of albino mice regarding Oedema, congestion and pyknosis were significant when compared with control group (I). These mild to moderate changes were consistent with the results of Logdberg et al (1988)[12], Harry et al (1996) [5], Anttila et al (1996) [13], Michaels et al (1991) [14] and Nowack et al (1993)[15].

GROUP III (Lead dose 4 mg/kg/day): Microscopic features of cerebellum of mice regarding Oedema, Necrosis, astrocytic proliferation, endotheial proliferation, congestion and pyknosis showed mild to moderate type of histological changes as compared to control group I. The difference was statistically significant in above mentioned morphological parameters. These findings are in agreement with the result of Anttila et al (1996)[13], Michaels et al (1991) [14] and Nowack et al (1993)[15].

Group IV (Lead dose 8mg/kg/day): Microscopic examination of cerebellum of mice regarding Oedema, necrosis, astrocytic proliferation, vascular changes i.e. endothelial proliferation and congestion and neuronal changes i.e., pyknosis showed moderate type of histological changes when compared with control group (I). The difference was significant statistically in above mentioned parameters. These findings are in favour of the results of Logdberg et al (1988)[12], Harry et al (1996)[5], Anttila et al (1996)[13], Michaels et al (1991)[14] and Nowack et al (1993)[15].

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