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Neurohistopathologicaleffectsofmercury on Hippocampus of Adult Albimo Rat

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ABSTRACT

Mercury is toxic to almost every organ of body, including central nervous system. The aim of present study is to observe the histopathological changes in the hippocampus of rat induced by oral administration of mercuric chloride in adult albino rats. A 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 mercuric chloride in distilled water for aperiod of 15 days, then animals of both groups were anaesthetized with ether and perfused with 10% formalin. Hippocampus was dissected out. 10µ thick sections, obtained by usual histological procedure, were stained with H&E. On light microscopic observation, hippocampus from experimental group revealed increased cellularity of neurons with marked pyknosis of nuclei, increased cellularity with highly pleomorphic neuronal cells and markedly hyperchromatic nuclei in the molecular cell layer It was concluded that mercury has toxic effects on the central nervous system including hippocampus which may explain the clinical manifestation of mercury neurotoxicity.

KEYWORDS : *Albino rats, hippocampus, mercuric chloride, neurotoxicity*

Introduction

Mercury intoxication can occur more through inhalation rather than ingestion of contaminated foods and drinks.Deposition of mercury rich industrial waste in Japan,drew the attention of the scientific society when it causedtriggering signs and symptoms in the local population like ataxia, speech impairment, visual field constriction,sensory disturbance, deafness, blindness, tremors, involuntary movements, mental retardation, coma and death (1). Mercury is an occupational hazard for dental staff (2), chloralkali factory workers (3), goldminers (4) etc. Mothers consuming diet containing mercury pass the toxicant to foetus (5) and to infants through breast milk (6). Subtle neurological disorders in children over mercury exposure have been widely reported (7). Disruption of attention, fine motor function and verbal memory due to exposure to low mercury levels in fish eating adults, has been documented (8). Reports showed vacuoles in the white matter of cerebellum, pericellular as well as periventricular edema and congestion of blood vessels after treatment of rats with mercury (9). In another study, oral and subcutaneous administration of mercuric chloride for eleven weeks, caused degenerative changes in cerebellum of rat (10). The aim of present studywas to see the effect of mercury on the histology of hippocampus which may explain the clinical signs and symptoms following mercury intoxication.

Material and Method

20 adult albino rats (10 male and 10 female) weighing approximately 120g were used in the present study. 10 rats with equal number of either sex were treated with mercuric chloride (0.330 mg /kg body weight while the remaining 10rats (5male and 5 female) served as control group and were given distilled water. Freshly prepared sterile solution of mercuric chloride in distilled water was used for oral administration as drinking water. This concentration was ascertained after a careful trial in order to find maximum survival days, which were 15 days. Then, rats were anaesthetized with ether and perfused with buffered 10% formalin. Brain was dissected out. 3mm thick coronally sliced pieces of hippocampus wereremoved and processed for paraffin embedding. Then, 10 µ thick sections were cut with rotary microtome. These sections were stained with H & E and observed under the light microscope.

Observations

Hjippocapus of control group shows the Normal distribution of the molecular and granular cell layer at 10x (Figure1). Under the light microscope, the hippocampus of the treated group shows increased cellularity of neurons with marked pyknosis of nuclei in the molecular cell layer at 10x(Figure2). At higher magnification, hippocampus of experimental group shows increased cellularity and highly pleomorphicneuronal cells with markedly hyperchromatic nuclei in the molecular cell layer(Figure 3).

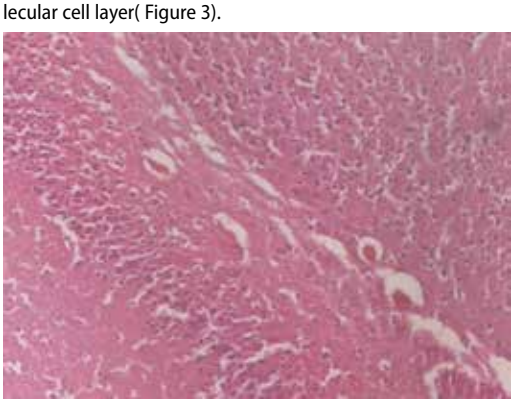

Figure:1. Photomicrograph of hjippocapus (control group) shows the Normal distribution of the molecular and granular cell layer. Haematoxylin and Eosin × 10X.

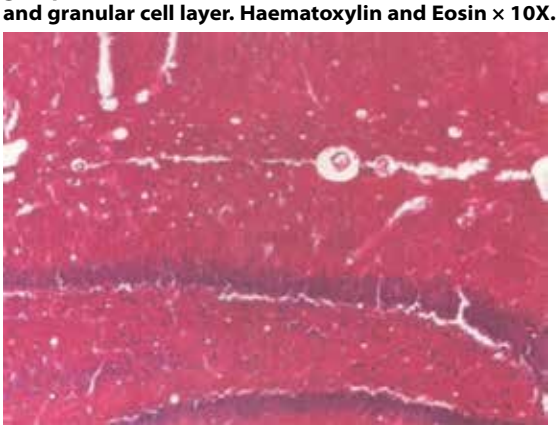

Figure:2. Photomicrograph f hippocampus (experimental group) shows increased cellularity of Neurons with marked pyknosis of nuclei in the molecular cell layer. Haematoxylin and Eosin × 10X

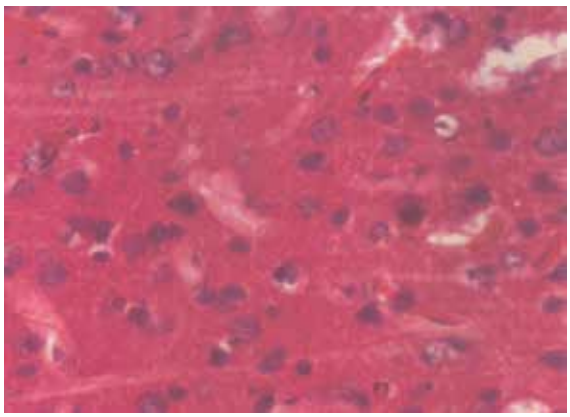

Figure:3. Photomicrograph of hippocampus (experimental group) shows increased cellularity with highly pleomorphic neuronal cells with markedly hyperchromatic nuclei in the molecular cell layer. Haematoxylin and Eosin × 40 X.

Discussion

Histological findings in the present study were suggestive of neurotoxic and degenerative effects of mercury on the hippocampus. In one of the studies, cerebellum showed pyknosis of nuclei of granular layer cells, edema between granular and molecular layer, degeneration of many purkinje cells (11). Earlier, it was also reported thatmercury has neurotoxic effects reflected in its ability to penetrate and damage Blood Brain Barrier system (12), (13). Another study, reported pathological lesions in brain secondary to mercuric chloride poisoning (14). Thinning and depletion of granular layer of the cerebellum, after mercury toxicity, has been reported (15,16). Reports are available, showing degeneration and necrosis of purkinje cells and shrinkage of neurons in cerebellum secondary to mercury poisoning (17). Mercury compounds can induce cerebellar degeneration, sensorimotor and gating disturbances, tremor, ataxia and depression (18,19,20). The histopathological changes in the hippocampus were observed in our study indicating the neurotoxic effects of mercury poisoning and correlated very well with the histological findings of the other studies on the brain in general, though almost negligible material is available specifically in relation to histopathological changes of hippocampus secondary to mercury poisoning.

Conclusion

It is concluded that exposure of rat to mercury for 15 days produces-demonstrable microscopic alterations in the hippocampus.

REFERENCES

1. Bernhoft RA. Mercury toxicity and t reatment: a review of the literature. Journal of Environmental and Public Health. 2012;2012:10pages.460508. | 2. Rowland, AS., Barid, D.O., 1994. The effect of occupational exposure to mercury vapour on the fertility of female dental assistants. Occup. Envirom. Med. 51 (1), 28-34. | 3. Berregard L, Hultberg B, Schultz A, and Sallsten G. 1988. Enzymuria in workers exposed to inorganic mercury. Int. Arch. Occup. Environ. Health 61:65-69. | 4. Grandjean, P., White, R.F., Nielson, A., Cleary, D., de Oliverira, Santos, E.C., 1999, Methylm,ercury neurotoxicity in Amazonian children downstream from goldmining. Environ. Health. Perspect. 107 (7), 587-592. | 5. Murata, K., Weihe, P., Budtz – Jorgensen, E., Joprgensen, P.J., Grandjean, P., 2004. Delayed brainstem auditory evoked potential latencies in 14-year-old children exposed to methylmercury. J. Pediatr. 144 (2), 177-183. | 6. Grandjean, P., weihe, P., White, R.F., 1995. Milestone development in infants exposed to methylmercury from human milk. Neurotoxicology 16(1), 27-34. | 7. Johnbson, C.L., 2004. In the environment: sources, toxicities, and prevention of exposure. Pediatr. Ann. 33 (7), 437-442. | 8. Yokoo, E.M., Valente, J.G., Grattan, L., Schmidt, S.L., Platt, I., Silbergeld, E.K., 2003. Low level methylmercury exposure effects neuropsychological function in adults. Environ. Health 2(1), 8. | 9. A.A. El – Sawak, Iman A. Abd El-Aziz and Samah S. Elsayed, Pathological investigation on the toxic effect of lead and mercury salts in Albino rats. Egypt. J. Comp. Path. & Clinic. Path. Vol. 22 No. 2 (March) 2009;280-30. | 10. Chang L and Hartman H.A. Blood, Brain Barrier dysfunction in experimental mercury intoxication. Acta Neuropathol (Berl) (1972): 21, 179-184. | 11. Ghusoon A.K. AL-Neamah, Rajiha A. AL. Naimi and Eman H.Y.AlTaae. Assessment the therapeutic effects of aqueous extracts ofCilantro and Garlic in mercuric chloride poisoning in rats. The Iraqi J. Vet Med. 36 (2):231-243; 2012. | 12. Gallagher, PJ. and Lee, RL. (1980).The role of biotransformation inorganic mercury Neurotoxicity .Toxicology, 15(2):129- 134. | 13. Bandy, S.C.; Anderson, CL.; Harringtan, ME. and Parasad, KN. (1979).The effects of organic and inorganic lead and mercury on neurotransmitter high-affinity transport and release mechanism . J. Environ. Res., 19(1):102-111. | 14. Schettler T. (2001). Toxic Threats to neurologic development of children. Environ Health perspect 109 Suppl 6:813-816. | 15. Sakamoto,. M.; Kakita, A,; Oliveria, R.B.; Pan, H.S. and takaliashi, H. (2004): "Dose dependent effects of methyl mercury administered (994):199-215. | 16. Ramzi, VK, and Stanely, I. (1994). Robbins pathological basis of diseases. 5th ed. Philadelphia, London, Toronto, Monterial, Pp:183-185. | 17. Berlin M, Fazackerley J, Nordberg G. (1969). The uptake of mercury in the brains of mammals exposed to mercury vapor and to mercuric salts. Arch Environ Health 18: 719-729. | 18. Hughes JA, Annau Z. (1976). Postnatal behaviuoral effects in mice after prenatal exposure to methylmercury. Pharmacol Biochem Behav 4: 385-391. | 19. Kishi R, Hashimoto K, Shimizu S, Kobayashi M. 1978. Behavioral changes and mercury concentrations in tissues of rats exposed to mercury vapor. Toxicol. Appl. Pharmacol. 46:555-566. | 20. Nahavadi A, Shahbazi A. (2010). Nitric Oxide is Protectvie Against Mercury Induced Depression. Basic Clin Neurosc 1:56-60. |