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NEURO HISTOLOGICAL EFFECTS OF CADMIUM ON THE OLFACTORY BULB Of ADULT ALBINO RAT

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ABSTRACT

The toxicity of cadmium, an environmental pollutant, is reported in almost all systems of human body though scarcely on nervous system. It's path physiological actions are related to body stores of Ca^{++}, Zn^{++}, of Cd^{++} on the olfactory bulb of albino rats to have an idea about it's corresponding toxicity on human beings. 8 Charles forster strain- rats received Cadmium chloride injections. Then olfactory bulb sections were obtained by standard methods after sacrificing the rats. The sections were stained by H & E, thionine and Glees silver stains. On microscopic observations some layers of olfactory bulb showed degenerative changes.

Key words: Cadmium Exposure, Olfactory Bulb, Albino Rats

Introduction

Cadmium, a heavy metal, is an environmental pollutant. Cd^{++} is used in industries like plastics, stabilisers, pigments, electroplating, alloys, batteries and chemicals and a component of insecticides, pesticides and fertilizers. Cd^{++} is toxic to every organ it's mainly toxic to kidneys and liver, effects of Cd^{++} on human nervous system are less well documented though CNS dysfunction and anosmia has been reported. (VorobJava R.A. 1957 & Adams R.G. &Vrabtree N. 1961). Average intake of Cd^{++} estimated 20-50mg/day.

Since studies regarding Cd^{++} neurotoxicity in the olfactory bulb are all the more scanty, the aim of this study is to possibly fill the lacuna in the knowledge of the subject.

Materials and methods

8 Charles' foster strain rats, 4 males & 4 females were taken. They were kept on stock ration diet and tap water.

Rats were divided in group A and group B with each group containing 4 rats. Group B rats (4) each received injections of cadmium chloride on alternate days.

Rats were individually housed in plastic cages. Rats were weighed on alternate days. 15gm food to each group rats daily. Group B i.e. half the number of rats received intraperitonealCdCL2, (99%) pure anhydrous) injection in 2mg/kg body weignt for 30 days. 24 hours after last injection, rats were sacrificed. Intra venous infusion set was used as perfusion appatus. 10% formlin solution in normal saline was used as perfusion fluid. In perfusion fixation, rats were anaesthetized by intra peritoneal injection of nembutol 35mg/kg body weight. Than thorax of rats opened. Next, 18 gauge needle introduced into ascending aorta through Lt ventricle. Than Rt. Atrium was widely opened and perfusion was done by formal saline at pressure of 5 feet of water pressure. Perfusion was stopped when head and tail stiffness was pronounced and there was oozing of perfusion fluid on cutting the snout with the scissors. Then brain was quickly removed. Next olfactory bulbs were cut and put in a fixative (formal saline) overnight. Then after usual procedures sections were cut at 10 thickness. Staining was done by haematoxylin and eosin, thionine and glees silver stains.

OBSERVATION AND RESULTS

Fig. 1:Photomicrograph of the olfactory bulbof an albino rat on normal diet and without cadmium, exposure. Thioninex 100 Sections of olfactory bulb in this group of rats showed the following features:

(a) *Lamina fibrosa;*

This is olfactory nerve fibre layer showing unmyelinatedfibres running in various directions forming a closed network. At some places these fibreswereseen to penetrate the olfactory glomeruli.

(b) *Lamina glomerulosa;*

It is clear, round or oval regions (olfactory glomeruli) made up of unmyelinatedfibres, surrounded by small sized periglomerular cells. Some small cells were also found scattered amongst the fibres within the olfactory glomeruli.

(c) *Outer plexiform layer;*

It is wider and clear zone of unmeilinated nerve fibres, widely scattered small medium and even some large sized cells were seen. Large size cells were like mitral cells. Some radially arranged nerve fibres were also seen.

(d) *Mitral cell layer;*

A few cell thick, thin layer of darkly staining large sized oval or elongated mitral cells with long axis lying in a radial direction.

(e) *The granular layer;*

It is thicker zone poorly demarcated from the mitral layer, containing small size granular cells, medium size neurons were also seen.

(f) *Inner plexiform layer;*

It is seen as lighter zone, apoarently made up of unmyelinated nerve fibres, small sized stellate neurons were also seen.

(g) *The sub-ependymal layer*

It appeared as darkly stained zone in the centre of the olfactory bulb, the cells were in the form of a dense collection of fine, sand like small sized cells.

Fig. 2(A) and (B):

Photomicrograph of the olfactory bulb of an albino rat on normal diet and exposed to cadmium. Thionine x 150 &Thionine x 400/

Degenerative changes were seen in *lamina fibrosa layer* (as loosened unmyelinated nerve fibres), *lamina glomerulosa* showed flattening and distortion of glomeruli over certain regions; degeneration of periglomerular at some places was seen, *granular layer* showed clumping and degeneration of many medium sized cells. Cells and fibres in other layers appear to be unaffected.

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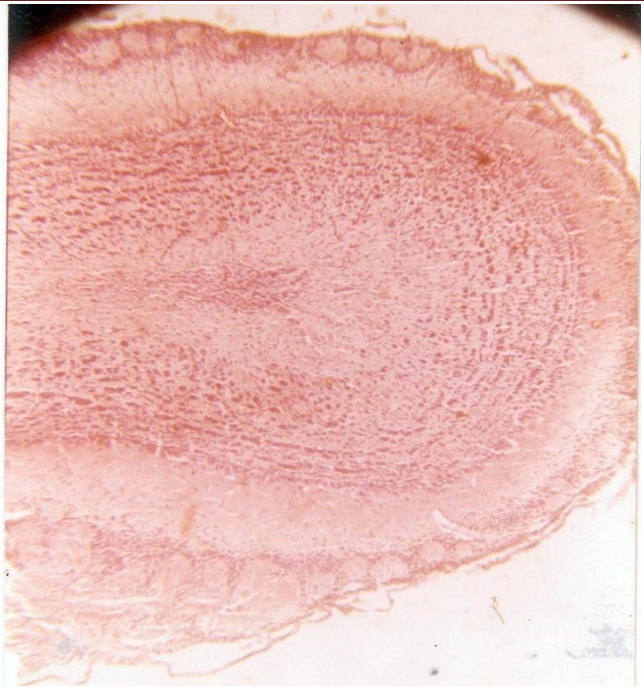

Fig 1.

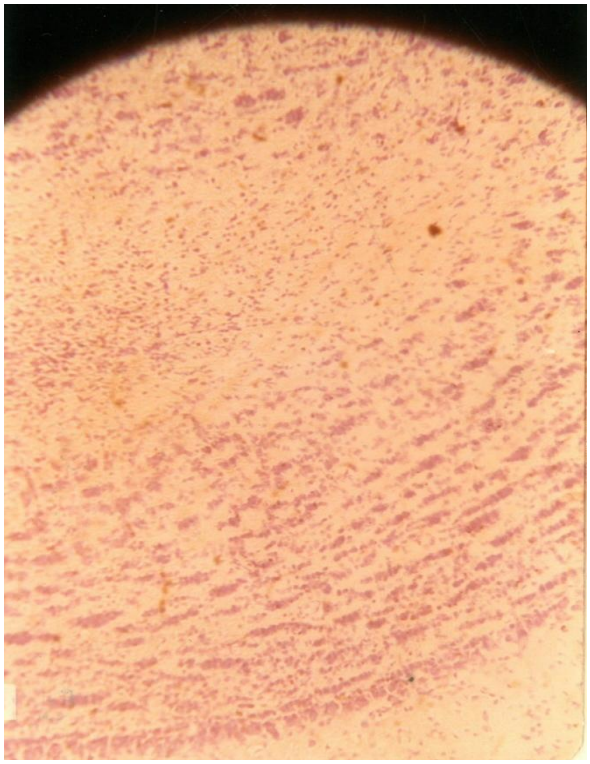

Fig 2a

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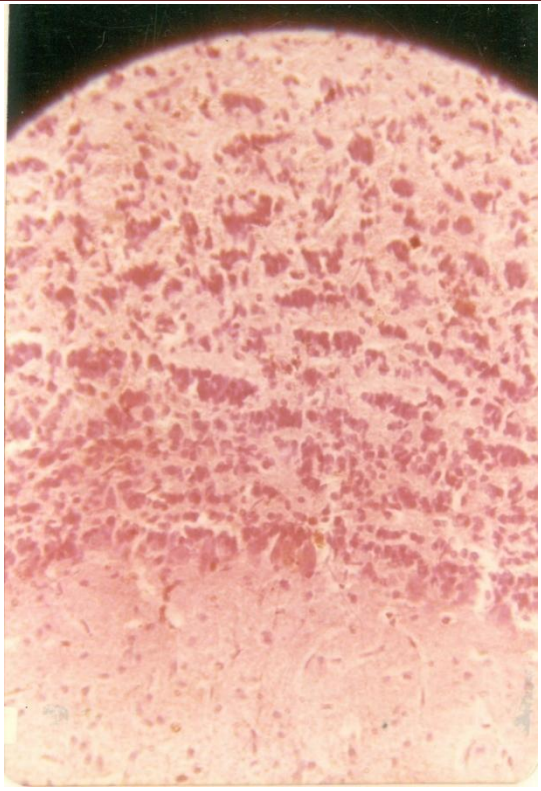

Fig 2b

DISCUSSION

Cd^{++} is toxic to every organ. Effect of Cd^{++} on the human nervous system are less well documented though CHS dysfunction and anosmia has .been reported.

In the present study, the dose of 2 mg/kg body weight doses of cadmium (Wong and KJaasen, 1982) and reported 14th day LD 50 value of a single administration of $Cd^{++}$to be 3.55 mg/kg body weight by theintra peritoneal route (Kotsonis and Klasseri, 1977). Microscopic findings of structural alterations in the olfactory bulb following Cd introxication of albino rats. Webster and Volois, (1981) found olfactory bulbs more culnerable to Cd exposure, than other parts of the brain. Any specific site of lesion in the olfactory bulb has not been reported by him. No worker has observed the effect of Cd exposureon the olfactory bulb of the mature rats which has been undertaken in the present study where sections of the olfactory bulb showed degenerative changes in lamina fibrosa layer (as loosened unmyelinated nerve fibers), lamina glomerulosashowed flattening and distoration of glomeruli over certain regions. The

periglomerular cells showed degeneration at some places, granular layer showed clumping and degeneration of many medium sized cells. Cells and fibers in other layers appear to be unaffected.

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