

FLUORIDE NEUROTOXICITY: THE PASSAGE OF FLUORIDE FROM BLOOD TO BRAIN

Sandeep Tripathi,^{1,2,*} Anurag Tomar,^{1,3} Abbas Ali Mahdi,⁴ Raja Roy,⁵ Virendra K Bajpay⁶
Lucknow and Jaipur, India

SUMMARY: It is suggested that excessive fluoride intake maybe a risk factor for neurotoxicity. Evidence from clinical and experimental studies has demonstrated that brain fluoride content increases after intestinal absorption. In the present study, we investigated the absorption of fluoride and its systemic retention in various organs in male albino rats. Various methodologies were used in the study including protein nuclear magnetic resonance (1H NMR), transmission electron microscopy (TEM), scanning electron microscopy (SEM), atomic absorption spectrophotometry, and the Morris water maze. 1H NMR and SEM study in blood and urine demonstrated that various metabonomic changes occurred in red blood cells (RBCs). Chronic fluoride neurotoxicity was most marked in the hippocampus followed by the hypothalamus, cerebellum and cerebrum. Various degrees of mitochondrial deterioration leading to apoptosis were observed in the hippocampus by TEM and biochemical studies. These were further investigated with different proteins and enzymes. Structural changes in synapses were apparent in the central nervous system. Taken together, these findings indicate the widespread neuropathology and focused axonal neurodegeneration, in association with peripheral organ toxicity, occurred in rats ingesting fluoride. Neurotoxicity was greatest in the areas with the highest fluoride retention. These results may be useful for developing therapeutic interventions to ameliorate fluoride toxicity.

Key words: 1H NMR; Blood; Brain; Electron microscopy; Fluoride; Morris water maze; Rats.

¹National Referral Centre for Fluoride Poisoning in India; ²Institute of Advanced Science & Technology, Nims University, Jaipur, India; ³Department of Paediatrics, Nims Medical College, Nims University, Jaipur, India; Department of Biochemistry, King George's Medical University, Lucknow-India; Centre for Biomedical Magnetic Resonance, SGPIMS, Lucknow, India; Electron Microscopy Division, Centre Drug Research Institute, Lucknow, India; *For correspondence: Dr Sandeep Tripathi, Incharge: National Referral Centre for Fluoride Poisoning in India (NRCFPI), Assistant Professor, Biotechnology, Institute of Advanced Sciences, Nims University, Shobha Nagar, Jaipur-303121, India; E-mail: sandeeptripathiphd@gmail.com ; Tel. No. +91-8769953286; Fax: +91-141-2605050, 91-1426-231635; Website: www.nimsuniversity.org