

Immunological abnormalities in humans chronically exposed to chlorpyrifos

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ABSTRACT. Twenty-nine individuals with chronic health complaints following exposure to Chlorpyrifos (CPS) were compared to three control groups (one positive and two negative) with respect to the following: (1) peripheral lymphocyte phenotypes; (2) autoantibodies (ANA, parietal cell, brush border, mitochondria, smooth muscle, thyroid gland, and CNS/PNS myelin); (3) mitogenesis to PHA and ConA. The data show an increase in CD26 expression, and decrease in per cent CD5 phenotype, decreased mitogenesis to PHA and ConA, and an increased frequency of autoantibodies. The alterations in these peripheral blood markers were unaffected by medications, age, sex or season. It is concluded that Chlorpyrifos, causes immunological changes.

INTRODUCTION. CPS (0,0-diethyl 0-[3,5,6-trichloropyridinol]) phosphorothionate) is a chlorinated organophosphate insecticide that is a moderate inhibitor via CPS oxon of acetylcholinesterase. The inhibition of this enzyme leads to signs and symptoms of overstimulation of the cholinergic system.^{1,2} The commercial product contains a number of chemicals, including but not limited to alkyl phosphates, alkyl phosphorothioates (sulfotepp), 3,5,6-trichloropyridinol (TCP) and solvents.³ Other adverse effects of CPS in animals and humans are reported as follows: 1) developmental neurotoxicity;⁴⁻⁷ 2) targeting of DNA, RNA, protein, nuclear transcription and cAMP signaling cascade in post natal brain neurogenesis;⁸⁻¹² 3) mitotic abnormalities, apoptosis and cytotoxicity in rat embryos and midbrain micromass cultures;^{13,14} 4) birth defects in humans;¹⁵ 5) decreased T cell blastogenesis to PHA and ConA with increased expression of CD4 and CD8 surface markers in rats¹⁶ and, 6) generation of reactive oxygen species, DNA damage and lactate acid dehydrogenase leakage in rat brain and liver¹⁷

We previously reported a preliminary study on immunological alterations observed in twelve individuals chronically exposed to CPS.¹⁸ In this paper we confirm and extend our earlier observations on changes in peripheral blood immunologic phenotype frequencies and on the presence of autoantibodies after exposure to CPS. In addition, these data show that the observations on changes in peripheral blood phenotype frequencies are not effected by medications, age, season, and sex. Finally, it is suggested that immune alterations, increased frequency of autoantibodies and increased rate of apoptosis are probably associated with chronic illness following exposure to CPS.

In conclusion, it is becoming increasingly apparent that certain individuals are more susceptible to the adverse effects of xenobiotics, experiencing chronic adverse health effects following exposure. Altered frequency and function of biomarkers, such as certain genes, enzymes, lymphocyte phenotypes, lymphokines, multiple autoantibodies as well as increased apoptosis appear to be associated with exposure to xenobiotics and subsequent chronic health problems. In addition, three potential mechanisms that may be responsible for these immune alterations are discussed.

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