Antibodies and Immune Profiles of Individuals Occupationally Exposed to Formaldehyde:

Six Case Reports

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Six patients with multiple subjective health complaints, which have been correlated with chronic exposure to formaldehyde during the course of their education and occupations, were tested for the existence of antibodies (IgE, IgM, IgG) to formaldehyde (F) conjugated to serum albumin (F-H SA). In addition, the percentage and absolute numbers of peripheral lymphocyte and lymphocyte subpopulations as determined by surface markers were investigated. Antibody titers to F-HSA were present as follows: IgE (2 patients), IgM (3 of 4 tested patients), and IgG (5 patients). Analysis of lymphocyte subpopulations showed T-helper/suppressor ratios ranging from 0.8 to 3.3. All 6 patients had elevated Ta1 cells (antigen memory cells), whereas Interleukin 2 receptor positive cells were within expected values. Following formaldehyde exposure, 5 of the patients complained of an initial flu-like illness from which they have not completely recovered. The sixth individual had a history of recurrent respiratory infections and surgical removal of hyperplastic ethmoid sinus tissue. The common occurrence of anti-F-HSA antibodies, flu-like illness, and Ta1 cells are interpreted as suggestive of a chronic antigenic stimulation of the immune system in these 6 patients. Further immunological work-up of additional subjects and immune parameters with similar history of formaldehyde exposure and subjective health complaints is warranted.

Introduction: Formaldehyde conjugates with human serum albumin (F-HSA), forms a new antigenic determinant [Horsfall, 1934; Pass and Marcus, 1970]. Subsequently, anti-F-HSA IgE, IgM and IgG antibodies have been demonstrated in experimental animals and humans in a variety of exposures. Antibodies to F-HSA of all isotypes have been found in dogs [Patterson et al., 1985], in mobile home dwellers [Thrasher et al., 1988], in occupational exposures [Wilhelmsson and Holmstrom, 1987] and in other environmental settings [Broughton and Thrasher, 1988]. In addition, modulation of cell-mediated immunity following inhalation exposure to formaldehyde has been reported. Pross et al. [1987] found increases in eosinophils, basophils and T-suppressor cells from acute formaldehyde exposure in patients with suspected asthma from urea-formaldehyde foam insulation. Other parameters of the immune profile, such as phytohemagglutinin stimulated mitogenesis. H/S ratio and NK cells were unchanged. On the other hand, individuals chronically exposed to formaldehyde in mobile homes have been shown to have perturbations in peripheral T-cells, effecting total number, H/S ratios; mitogen [PHA, Con A, PWM] stimulation, and Ta1 cells [Thrasher et al. 1987; Broughton and Thrasher, 1988].

In this study we report the existence of IgE, IgM and IgG antibodies to F-HSA as well as modulations in lymphocyte subsets in 6 individuals occupationally exposed to formaldehyde. In addition, these patients have ongoing health problems similar to those described in workers with multiple chemical sensitivity [Cullen, 1987].

Conclusion: The task confronting the immune system involves encounter, recognition, activation, deployment, discrimination, and regulation. Thus investigation of the effects of chronic chemical exposure on the immune system should include as many of these functions as possible. The observations made on these 6 patients make this apparent. First, if one examines the immune profiles with respect to percentage and numbers of T-, T-helper, T-suppressor, and B cells and H/S ratios, it appears that the deviations may not differ from expected values. However, the anti-F-HSA isotypes demonstrate that encounter, recognition and discrimination have occurred with respect to formaldehyde exposure. Moreover, activation and subsequent deployment of the immune system are indicated by the elevated numbers of Ta1 cells. Thus, it appears that the immune system may be activated rather than suppressed in some chemically sensitive individuals. Investigations into elements of immune activation and the presence of anti-inflammatory agents may prove to be productive in the elucidation of the health problems of these individuals [Stanworth, 1985; Thrasher and Broughton, 1988].

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