Complement factors in workers exposed to silicosis

A number of complement parameters have been investigated in gold miners and ex-gold miners coming to the Medical Bureau for Occupational Diseases in Johannesburg for medical examinations. The subjects were white men aged 48 to 71, and all had been exposed to silica in gold mines for prolonged periods. Subjects who had experienced appreciable exposures to other dust—that is, asbestos—were excluded. Exposure was expressed as “low dose equivalent years” (LDEY), and one year of high dust exposure was considered to be the equivalent of two years’ low dust exposure. With this conversion factor the range of exposure of the subjects in LDEY was 25 to 86 years.

Twelve men had radiological evidence of silicosis without lung function evidence of chronic obstructive lung disease (COLD); six had both silicosis and COLD; 17 COLD alone; and 12 had long exposure to silica but had neither silicosis nor COLD. The forced expiratory volume in one second (FEV₁) as a percentage of predicted, the maximum midexpiratory flow, and the percentage of FEV₁ of the forced vital capacity were the parameters used to establish the presence of COLD. Control subjects were 12 white men (aged 34–68) from the professional and clerical workers of the National Centre for Occupational Health. Posteroanterior chest radiographs obtained on these individuals were all normal.

Complement haemolytic activity (CH50) was measured by a modification of the method of Hook and Muschel and the concentration of a complement breakdown product C3c and the serum concentrations of complement component C4 determined by rocket immunelectrophoresis.

Results

Data on the CH50 activity are shown in the figure. Although there appears to be considerable variability among individuals within each group, more patients with COLD or silicosis had an increased haemolytic complement activity when compared with both the control group and the exposed sub-

jects with no evidence of either COLD or silicosis. Four out of 12 exposed subjects with no evidence of disease also had increased complement activity suggesting that exposure to silica itself might have some effect on the complement system.

The concentration of the fourth complement component (C4) also showed differences in the groups studied. A greater number of silicotic subjects (66%) had a raised serum concentration of C4 when compared with the subjects with COLD (41%). Both groups showed higher serum concentrations of C4 than either the exposed or control groups.

A χ² test using 2 × 5 tables was performed for both sets of data, and a significance of <1% was found for the CH50 and of <5% for the C4 assays. Thus although expected frequencies are rather small and must therefore be regarded with caution, the results are considered statistically conclusive. A lack of association between duration of exposure (in LDEY) and CH50 or C4 was shown. No differences between the different groups were observed when C3c was measured.

Comment

Levels of complement activity and the fourth component of complement have been found to vary widely in patients with collagen diseases such as systemic lupus erythematosus and diffuse pulmonary fibrosis, and to be raised in rheumatoid arthritis.
The increased levels of haemolytic complement activity found in this investigation may thus be related to the increased prevalence of autoimmune phenomena found in silicosis, while the increased serum concentrations of C4 could emanate from an increase in the rate of synthesis of complement by mononuclear phagocytes activated by exposure to silica. Further studies on altered levels of haemolytic activity are necessary to elucidate these findings as well as investigations into the possible activation of the alternate complement pathway.

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References