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THE RELATIONSHIP BETWEEN ASBESTOS BODIES, SERUM IMMUNOGLOBULIN LEVELS AND X-RAY CHANGES IN ASBESTOS WORKERS

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In this study 52 workers from an asbestos factory were examined. They were placed in three groups: Group 1, directly exposed to asbestos with X-ray changes of the lungs indicative of asbestosis, Group 2 also directly exposed to asbestos, but without X-ray changes, and Group 3 not directly exposed to asbestos. The lungs and pleura of all the examined workers were X-rayed in the anteroposterior projection. Sputum samples were taken to determine the presence of asbestos bodies, and the level of immunoglobulins (IgG, IgM and IgA) was determined in sera. In workers exposed to asbestos, a correlation between the number of asbestos bodies and X-ray changes was not found. The level of immunoglobulins in Group 1 workers was significantly higher than in Groups 2 and 3. In the former group, there were significantly more workers with increased IgG level than in the latter groups.

Immunological disorders as a result of the fibrogenic effect of asbestos dust are a well-known phenomenon which has been much dealt with in literature (1 – 3).

The aim of this study was to establish a possible relationship between X-ray changes, the number of asbestos bodies and the level of serum immunoglobulins in a group of asbestos workers.

SUBJECTS AND METHODS

Out of 79 workers from the asbestos section of a factory for cement and asbestos-cement products, 52 were selected for the study. Their average age was 39 years, their average length of service 16.2 years. The examined workers were placed into three groups.

Group 1 consisted of 11 workers with a history of X-ray changes in the lungs, that is, of asbestosis. Those workers were directly exposed to asbestos dust. Group 2 included

34 workers who were also directly exposed to asbestos, but without X-ray changes indicative of asbestosis. The workers from the two groups worked in the production of asbestos-cement blocks for which the basic raw material was chrysotile asbestos. Group 3 included seven workers, also from the asbestos section of the factory, who were not directly exposed to asbestos.

The lungs and pleura of all the examined workers were X-rayed in the anteroposterior projection. Our interpretation of the radiographs was based on the 1980 ILO classification of pneumoconioses. As part of examination, sputum samples were taken from the workers to determine the presence of asbestos bodies. This was done on native microscopic slides.

In the workers' sera three classes of immunoglobulins were quantitatively determined: IgG, IgM and IgA on RID plates, made by the »Torlak,« Institute for Immunology and Virusology in Belgrade, following the WHO standards. Results were analysed by χ^2 and Student's t-tests.

RESULTS AND DISCUSSION

The presence of asbestos bodies was determined in the sputum of all 52 workers. The number of bodies varied from 1 or 2 to over 20 within one field of vision. As many as 36 workers, had one to five asbestos bodies in a single field of vision.

There was no significant difference between the groups with respect to the number of asbestos bodies in the sputum (Table 1). There was, likewise, no significant difference between the workers with radiographic (X-ray) changes suggesting asbestosis and those with normal radiographic findings (Groups 2 and 3) with respect to the number of asbestos bodies.

Table 1

The number of asbestos bodies within a single field of vision in the sputum of the examined groups of workers

Group	Number of asbestos bodies			Total
	1 to 5	6 to 10	over 10	
Group 1	5	5	1	11
Group 2	6	1	2	9
Group 3	25	6	1	32
Total	36	12	4	52

$\chi^2 = 4.65$; $p > 0.05$.

The results did not confirm a connection between the asbestos bodies in the sputum and the radiographic pneumoconiotic changes. This is an additional proof that the presence of asbestos bodies in the sputum is just a verification of a person's exposure to asbestos.

Table 2

The number of asbestos bodies in the sputum of workers with X-ray pneumoconiotic changes and of those with normal radiographic findings with respect to asbestosis

	1 to 5	6 to 10	over 10	Total
Workers with pneumoconiosis	5	5	1	11
Workers without pneumoconiosis	31	7	3	41
Total	36	12	4	52

$\chi^2 = 4.65$; $p > 0.05$. D. N. S.

Table 3

The mean value and the standard deviation of serum immunoglobulins in the examined groups (in g/L)

	Group 1 $\chi^2 \pm$ SD	Group 2 $\chi^2 \pm$ SD	Group 3 $\chi^2 \pm$ SD
IgG	18.15 ± 1.32	14.8 ± 3.70	11.11 ± 2.86
IgA	3.54 ± 2.13	2.74 ± 1.00	2.22 ± 0.77
IgM	1.51 ± 0.57	1.56 ± 0.75	1.22 ± 0.57

As far as the immunological status was concerned the following results were obtained for the three groups: Group 1: in 10 persons the serum IgG level was above normal and in one worker it was within normal range. In only one worker belonging to this group the IgM level was higher, and also, in one worker only, the IgA level was lower. Group 2: in two workers a higher IgG level was determined, in one person the IgM level was lower and in two workers the IgA level was higher. Group 3: the IgG level was within normal values in all workers, the IgM level was lower in one worker, and the IgA level was higher in one worker, and lower in one worker.

The mean values of the three classes of serum immunoglobulins were calculated and the significance of the difference was determined for individual, previously selected, workers. As part of the statistical evaluation of the results, the significance of the differences in the mean values of particular classes of immunoglobulins was also determined in separate groups of workers.

Student's t-test showed a significant difference in the mean values of IgG between Group 1 and Group 2 ($p < 0.001$), Group 2 and Group 3 ($p < 0.05$), and between Group 1 and Group 3 ($p < 0.001$). There was no significant difference in the mean values of IgA or IgM.

As no significant deviations in IgM and IgA levels were observed either in the groups or among the individuals, our study of the relationship of the number of asbestos bodies, radiographic changes suggesting pneumoconiosis and the immunological status

Table 4

The number of asbestos bodies in the sputum of workers with an increased IgG level and in those with normal or decreased serum IgG level

	1 to 5	6 to 10	over 10	Total
IgG (increased)	6	5	1	12
IgG (normal or decreased)	30	7	3	40
Total	36	12	4	52

was reduced to the relationship between asbestos bodies, radiographic changes and the IgG type of immunoglobulins.

The χ^2 test did not point to any significant difference between the workers with an increased IgG level and those with normal or decreased IgG level in serum, in respect to the number of asbestos bodies.

The statistical evaluation ($\chi^2 = 33.6$; $p < 0.05$) indicated that the number of workers with radiographic changes in whom the level of IgG was increased, was significantly greater than the number of workers without such changes.

However, the results indicated a significantly higher IgG level in workers with radiographic changes (Group 1) than in those directly exposed to asbestos but without radiographic changes (Group 2) or in those who were not directly exposed to asbestos (Group 3). Numerous studies point to immunological disorders that are directly or indirectly connected with exposure to asbestos. Under experimental conditions, injections of crystalline asbestos to animals, with a concurrent antigenic stimulation, resulted in a greater increase in gammaglobulin level than that observed when immunization was not enhanced by concurrent administration of crystalline chrysotile (4).

Table 5

The radiographic findings in workers with an increased IgG level and in those with normal or decreased serum IgG level

Radiographic findings	Increased IgG	Normal or decreased IgG	Total
Workers with X-ray changes	10	1	11
Workers without X-ray changes	2	39	41
Total	12	40	52

Immunological disorders, i.e. significantly increased levels of IgG, IgM and IgA in patients with asbestosis and in those with a long exposure to asbestos as compared to

unexposed subjects and those exposed to asbestos but without pulmonary changes have also been reported by *Lange and co-workers* (5). Their results confirm a correlation between immunological changes and length of exposure. On the other hand, *El-Sefewy and co-workers* (3) failed to notice any correlation between immunological disorders and length of exposure, but they recorded (by immunoelectrophoresis) an increase in glycoprotein, lipoprotein, and transferin, content as well as in IgG, IgM and IgA levels. The increase in IgG and IgM fractions is characteristic of the immunological response in chronic inflammatory diseases.

IgA fraction is characteristic of antibodies in autoimmune diseases (6). *Pernis* (1) suggested that immunological changes pointed to the fact that the pathological mechanisms of asbestosis, like those of silicosis, included immunological reactions as well. The toxic effect of asbestos fibres upon cellular membranes has already been established. The slow destruction of macrophages can be suspected as a factor contributing to pneumofibrosis (7). It is believed that the very same mechanism causes immunological disorders in persons exposed to asbestos.

To conclude, there is no connection between the number of asbestos bodies in sputum, radiographic changes and the immunological status of the workers from the asbestos factory. A statistically significant increase was observed in the level of IgG in the group of workers who were directly exposed to asbestos and had radiographic changes, as compared to the group directly exposed but without radiographic changes, or the group of workers who were not directly involved in the process of production. The number of workers with radiographic changes indicative of asbestosis, with IgG levels above normal was significantly larger. However, our conclusions should be viewed taking into consideration the low sensitivity of the method applied in the estimation of immunoglobulins.

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Sažetak

ODNOS IZMEĐU AZBESTNIH TELAŠACA, SERUMSKIH IMUNOGLOBULINA I RENTGENOGRAFSKIH PROMENA KOD RADNIKA U AZBESTNOJ INDUSTRIJI

Ispitivanja su obuhvatila 52 radnika azbestnog pogona podeljena u tri grupe (I grupa radnika, direktno izloženih azbestu, sa rendgenografskim promenama u smislu azbestoze, II grupa takođe direktno izloženih radnika bez RDG promena i III grupa radnika koji nisu direktno izloženi azbestu). Svim ispitivanim radnicima napravljena je rendgenografija pluća i pleure, određivan je broj azbestnih telašaca u sputumu i nivo serumskih imunoglobulina (IgG, IgM i IgA).

Kod ispitivane grupe azbestnih radnika izloženih azbestu nije utvrđena povezanost između broja azbestnih telašaca u sputumu sa RDG promenama i imunološkim statusom.

Utvrđen je statistički značajno viši nivo imunoglobulina G kod I grupe radnika u odnosu na II i III grupu prethodno kategoriziranih radnika.

Signifikantno je veći broj radnika I grupe sa povećanim nivoom IgG.

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