ASBESTOS BODIES IN BRONCHOALVEOLAR LAVAGE FLUID IN VIEW OF OCCUPATION, PLEURAL CHANGES, AND BRONCHOGENIC CARCINOMA

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The asbestos content of lung tissue reflects the asbestos exposure during life. One finds both naked or uncoated fibres, and fibres coated with a ferroproteinous material also called ferruginous bodies or asbestos bodies (AB's).[1,5] The great majority of the AB's contain an amphibole in its core.[2] AB's can easily be identified in bronchoalveolar lavage fluid.[4,6] Their number correlates with the number found in lung tissue.[3] The aim of the present study is to explore the relationship between AB concentration in bronchoalveolar lavage fluid, on the one hand, and the occupational history, the presence of benign pleural changes, and the presence of primary bronchogenic carcinoma, on the other hand.

MATERIAL AND METHODS

Bronchoalveolar lavage was performed during routine diagnostic bronchoscopy, under local anesthesia, in 275 consecutive patients (257 male, mean age 60.9 ± 9.2 yr) who could tolerate the procedure safely. A fiberoptic bronchoscope was securely wedged in a segment of either the middle lobe or the lingula, which was then washed with a minimum of two aliquots of 50 ml of normal saline solution. About 50% of the second aliquot was recovered and used for analysis.

About 20 ml of lavage fluid, mixed with 40 ml of bleach, was incubated at 40°C for 2 hours. The fluid was then sucked through a 0.45 micrometer pore size cellulose esters filter, subsequently rinsed twice with water and once with alcohol 25%. The filters, mounted and cleared, were examined at 400 × magnification under phase contrast. A known portion of the filter, approximately 400 fields, were examined for AB's, from which the original concentration of AB's could be calculated. The logarithmic means were used in all comparisons; one AB was added to all counts so that no concentration came out lower than 0.01/ml, which is an artifact.

Complete occupational and smoke histories were taken. The chest radiographs were read according to the ILO classification system for pneumoconioses. The following benign pleural changes were considered for analysis: pleural effusion, diffuse pleural thickening, markedly obliterated costophrenic angle, pleural plaques calcified or not.

Control groups consisted of an equal number of patients, matched for sex, age (± 4 yr), and smoking habit (± 50% of total cigarettes smoked). Asbestos workers, i.e. workers with explicit asbestos exposure, were eliminated from matched comparisons for fear of bias. Indeed most of these were referred explicitly for detection of AB's.

RESULTS

The concentrations of AB's in lavage fluid, range 0.01–130/ml, appear to follow a logarithmic distribution in this sample of 275 patients. The 257 male subjects could be categorized in five groups, unmatched for age and smoking history, according to occupation. These groups and corresponding mean AB concentrations are: (a) 11 asbestos workers, 21.9 ± 41/ml; (b) 50 metal workers, welders, plumbers, and heating workers, 1.4 ± 7.8/ml; (c) 47 coal miners, 1.4 ± 7.9/ml; (d) 103 other blue collar workers, 0.3 ± 5.4/ml; and (e) 46 farmers, staff, and other white collar workers, 0.1 ± 5.7/ml. The mean concentrations found in the first four groups are all significantly higher than in the one found in the last group.

Metal workers (n=25) also had significantly higher AB counts if compared, not with group (e), but with an equal number of matched controls (1.23/ml versus 0.34/ml, P=0.02). The same was found for coal miners (n=37, 1.78/ml versus 0.23/ml, $P=10^{-5}$).

Likewise, subjects with bilaterial pleural changes (n=50) had significantly higher AB counts than their matched controls (1.8/ml versus 0.3/ml, 2P=0.001). However, subjects with unilateral, pleural changes (n=31) did not differ significantly from the controls (0.7/ml versus 0.4/ml).

The patients with primary bronchogenic carcinoma (n=69) had a higher mean AB concentration than matched controls, but the difference was not significant (0.76/ml versus 0.44/ml, P=0.1).

DISCUSSION

It is not surprising that the highest AB concentrations were found in asbestos workers. Of more interest is the increased number of AB's found in people who, in the majority of cases, did not mention any contact with asbestos. They constitute nevertheless a group of workers with probable asbestos exposure: steel and foundry workers, metal construction workers, welders, plumbers, central heating workers, and other workers who may use asbestos as sealing or heat insulator. It is somewhat surprising that a similar distribution of AB concentrations was found in coal miners. The Belgian geological structures contain no asbestos, but the material has been applied in the past as fire protection, among other uses. Another possible explanation is that some of these AB's have cores made of carbon fibre rather than asbestos. The present study cannot answer this.

We have distinguished a group of blue collar workers, who definitely had no explicit occupational exposure to asbestos, although sporadic contact remains possible. This group too had a significant, but small, increase of AB's, in comparison with the group of people with occupations outside of industry. These non-industrial workers have rather low AB concentrations: less than 1/ml in 67% of them, less than 3/ml in 84%, and less than 10/ml in 93%. Even this group shows some overlap with all other groups. We do not know for sure the source of occasional high AB counts, but in some cases the hobby activity may have been responsible.

It is known that asbestos exposure can cause any of the benign pleural changes we have considered in this study. We have treated these entities as a whole. Separating them is often difficult, as often they occur together, radiologically they may overlap, and finally one type of lesion can evolve into another (e.g. pleural effusion into pleural thickening). This study shows clearly, perhaps not surprisingly, that bilateral benign pleural changes (of any type are much more indicative of previous asbestos exposure than are the unilateral ones.

The relationship of substantial asbestos exposure and increased incidence of bronchogenic carcinoma is well established. We tested the more subtle hypothesis, that bronchogenic carcinoma in the general population might develop more frequently in the presence of a moderate level of asbestos impregnation of the lungs. To elucidate this, the group of 69 male patients with bronchogenic carcinoma was compared with a group of matched controls. The carcinoma cases indeed showed a higher mean AB concentration, but the difference was not significant although one might suspect a trend (P=0.1). This is in agreement with studies wherein the asbestos contents of lung tissue were compared.[7] A major influence thus of moderate asbestos impregnation on the incidence of lung cancer does not seem to exist. The final answer to this question must await the comparison of larger groups and identification of the cores of the AB's also would be desirable.

CONCLUSIONS

Our study of AB's in bronchoalveolar lavage fluid yields the following conclusions: (a) There is a gradation of AB concentrations related to occupational history; (b) increased AB concentrations correlate with the presence of benign pleural changes, when visible bilaterally on a standard chest radiograph; and (c) AB concentrations are not significantly increased in men, non-asbestos workers, with bronchogenic carcinoma.

REFERENCES

1. Churg, A.: Fiber Counting and Analysis in the Diagnosis of Asbestos Related Disease. *Hum. Pathol.* 13:381-392 (1982).
2. Churg, A., Warnock, M.L., Green, N.: Analysis of the Cores of Ferruginous (Asbestos) Bodies from the General Population. II. True Asbestos Bodies and Pseudoasbestos Bodies. *Lab Invest.* 40:31-38 (1979).
3. De Vuyst, P., Dumortier, P., Moulin, E., Yourassowsky, N., Roomans, P., de Francquen, P., Yernault, J.C.: Asbestos Bodies in Bronchoalveolar Lavage Reflect Lung Asbestos Body Concentration. *Eur. Respir. J.* 1:362-367 (1988).
4. De Vuyst, P., Jedwab, J., Dumortier, P., Vandermoten, G., Van de Weyer, R., Yernault, J.C.: Asbestos Bodies in Bronchoalveolar Lavage. *Am. Rev. Respir. Dis.* 126:972-976 (1982).
5. Morgan, A., Holmes, A.: Concentration and Dimension of Coated and Uncoated Fibers in Human Lungs. *Br. J. Ind. Med.* 37:25-32 (1980).
6. Sebastien, P.: Possibilites Actuelles de la Biometrologie des Poussieres sur Echantillons de Liquide de Lavage Bronchoalveolaire. *Ann. Biol. Clin.* 40:279-293 (1982).
7. Whitwell, F., Scott, J., Grimshaw, M.: Relationship Between Occupations and Asbestos-Fibre Content of the Lungs in Patients with Pleural Mesothelioma, Lung Carcinoma and Other Diseases. *Thorax* 32:377-386 (1977).

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