SHORT REPORT

Asbestosis and lobar site of lung cancer

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Abstract

Objective—To assess the evidence for the hypothesis that lung cancer has a predilection for the lower lobes in workers with asbestosis.

Method—A review of the available literature with relevant information.

Results—Six published reports were analysed. In four studies limited to series of cases with diagnoses of asbestosis, three showed lower lobe predominance of lung cancer whereas the fourth study included cases in which the radiographic readings did not meet the usual criterion of profusion for asbestosis. One cohort study showed lower lobe predominance; the other reported only 33% lower lobe cancers compared with 20% in unexposed controls.

Conclusion—There is some support for the hypothesis but more studies are needed.

(Occup Environ Med 2000;57:358–360)

Keywords: asbestosis; asbestosis; lung cancer

The anatomical sites for the origin of lung cancer can be established in most cases. In the general population the disease originates predominantly in the upper lobes. This has been found consistently in several studies.1–5 By contrast, there have been few studies on the lobar origin of lung cancer among people with asbestosis. The results have been inconsistent.

Methods

Publications were collected through an ongoing search of Medline and bibliographies of papers published in English. Data sought included the source of material, period in which the material was collected, the number of cases of lung cancer studied, and for cohorts the population size, stratification by asbestosis, criteria for the diagnosis of asbestosis, the denominator used to calculate the percentage of lower lobe tumours, the number of control (unexposed) cases, criteria for the lack of exposure, and percentage of lower lobe cancers in the controls. Differences between percentages were evaluated by $\chi^2$.

Results

Twelve studies were found with information on lobar site of lung cancer in people exposed to asbestos. These were divided into three groups: (1) four collections of cases of lung cancer said to have asbestosis7–10; (2) two cohorts of asbestos workers followed over a period of time11,12; (3) six collections of cases of lung cancer stratified in five by exposure to asbestos from occupational history and in one by counts of asbestosis bodies in the lung.13–15 Group 3 was excluded because the source of material was predominantly necropsies13–15 or surgical14,16 so these studies were subject to selection bias.

GROUP 2

Only two cohort studies have been published with information on site of lung cancer among workers exposed to asbestos (table). In 1965 Jacob and Anspach17 reported an investigation of all workers exposed to asbestos in Dresden, Germany, covering the period 1952–64. The data base originated in a city wide registry established in 1952 for 2636 exposed workers including those with asbestosis. The entire population of Dresden in the same period provided the control data.
The number with asbestosis was 721 (27%) and 30 cases of lung cancer included 24 (80%) with asbestosis. Asbestosis was diagnosed with a chest radiograph classification ranging from “suspect” through three stages of increasing severity. The risk of lung cancer was increased only among workers with asbestosis compared with the general population, after adjustment for age and sex. With the sum of cancers in the upper and lower lobes as the denominator, 68.8% of cases with asbestosis originated in the lower lobes compared with 28.6% in the general population. There was no information on the method of assessing the lobar site of origin for the lung cancers.

Brodkin et al. published the other cohort study 32 years later with data from a double blind randomised cancer chemoprevention trial. They compared 4060 asbestos workers with 14 254 heavy cigarette smokers over the period 1985–96. Lung cancer developed in 73 with 14 254 heavy cigarette smokers over the period 1985–96. An era during which there was a marked decline in exposure to asbestos, improved surveillance, and falling risks of relevant disease. The early reports provided less detail than the later ones. The source of material was seldom population based and often poorly defined. The method for diagnosis of asbestosis varied.

The finding that there is a tendency to increased frequency of lower lobe lung cancers in the presence of asbestosis is consistent with the fact that asbestos exposures were considerably greater in workers followed up in 1952–64 than in those followed up in 1985–96.

**Discussion**

There are several problems in assessing the literature on this subject. There were few studies. The papers were published over a long period 1965–1998 and covered periods from before 1952 to 1996, an era during which there was a marked decline in exposure to asbestos, improving surveillance, and falling risks of relevant disease. The early reports provided less detail than the later ones. The source of material was seldom population based and often poorly defined. The method for diagnosis of asbestosis varied. Other differences between the two studies may account for contrasting results but these are difficult to evaluate. For example, the radiographic systems for classifying the degree of small irregular opacities were different in the two studies and it is not possible to equate them. In the study of Jacob and Anspach the classification was a crude one originated by Saupe, who, according to Bohlig, suggested the system which evolved into the ILO classification with ongoing refinements. If we were to assume that stages II and III disease in the earlier study were equivalent to the ILO categories 2 and 3 in the later study, the frequency was 28% in the earlier study and only 11% in the later one. This would be consistent with the fact that asbestosis exposures were considerably greater in workers followed up in 1952–64 than in those followed up in 1985–96.

### Table 1 Frequency of lower lobe cancers in cohort studies

<table>
<thead>
<tr>
<th>Author and year</th>
<th>Source of material</th>
<th>Cancer site denominator</th>
<th>Lower lobe %</th>
<th>Control group</th>
<th>Lower lobe %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacob and Anspach 1965</td>
<td>Registry of all asbestos workers in Dresden</td>
<td>Upper + lower lobes</td>
<td>68.8</td>
<td>Dresden population</td>
<td>28.6</td>
</tr>
<tr>
<td>Brodkin et al 1997</td>
<td>Asbestos workers</td>
<td>Upper + lower lobes</td>
<td>32.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brodkin et al 1997</td>
<td>Asbestos workers</td>
<td>Yes, by profusion of small irregular opacities on x-ray film</td>
<td>32.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Odds ratio calculated by authors: 1.92 (95% CI 1.03 to 3.55). One possible flaw may be the varying interval between the original chest radiograph and the diagnosis of lung cancer: the mean interval was 4 years and ranged up to 10 years. This gap provided a period during which there could have been substantial increase in new cases of asbestosis or progression from low to high profusion of small irregular opacities.

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chances for errors during DNA replication, leading to neoplasia and limiting repair of DNA damage induced by mutagens—such as those in cigarette smoke. How these mechanisms relate to bronchogenic carcinoma is unclear.

**Conclusion**

The published information providing data for the hypothesis that lung cancer has a predilection for the lower lobes in the presence of asbestosis is limited. Confirmation requires more detailed studies with good epidemiological design.