

J. industr. Med., 1965, 22, 261.

MESOTHELIOMA OF PLEURA AND PERITONEUM FOLLOWING EXPOSURE TO ASBESTOS IN THE LONDON AREA

BY

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(RECEIVED FOR PUBLICATION FEBRUARY 11, 1965)

A series of 83 patients from the London Hospital with a diagnosis of mesothelioma confirmed by necropsy or biopsy has been studied for possible exposure to asbestos. The series consisted of 41 men and 42 women; 27 of the patients had peritoneal and 56 pleural tumours. The earliest death recorded was in 1917, but only 10 of the series died before 1950 and 40 (48%) between 1960 and 1964.

In 76 of the series full occupational and residential histories were obtained. Forty (52.6%) gave a history of occupational or domestic (living in the same house as an asbestos worker) exposure to asbestos compared with nine (11.8%) out of 76 patients from the same hospital suffering from other diseases ($P < 0.001$). None of the 17 suspected cases of mesothelioma, rejected on pathological grounds, was found to have had any exposure to asbestos. There was also evidence that neighbourhood exposures may be important. Among those with no evidence of occupational or domestic exposures, 30.6% of the mesothelioma patients and 7.6% of the in-patients with other diseases lived within half a mile of an asbestos factory ($P < 0.01$). Out of the 31 patients with occupational exposures only 10 were in jobs scheduled under the Asbestos Regulations of 1931. The interval between first exposure and the development of the terminal illness of mesothelioma ranged between 16 and 55 years.

In 47 patients in the mesothelioma series, lung tissue or sputum was available for examination. In 30 (62.5%), either asbestosis or asbestos bodies were present.

In recent years, the association between exposure to asbestos dust and cancer of the lung and other malignant neoplasms has been the subject of much research (leading article, 1964). Wagner, Sieggs, and Marchand (1960) described the occurrence of mesothelioma of the pleura in those exposed to crocidolite asbestos in the mining districts of South Africa, and this has stimulated further studies of the occupational histories of patients suffering from this tumour (Owen, 1964; Fowler, Sloper, and Warner, 1964).

The present investigation concerns patients in whom mesothelioma had been diagnosed at the London Hospital during the past 50 years. After examining the necropsy and biopsy specimens held in the pathology department, Hourihane (1964) confirmed a diagnosis of mesothelioma in 83 patients, of whom 41 were men and 42 women. Thirty-one of the men had pleural tumours and 10 peritoneal;

among the women, 25 had pleural and 17 peritoneal tumours.

The aim of this study has been to establish the occupational histories of these patients and to trace any other possible exposure to asbestos. There were four surviving patients at the outset of the investigation, but these have subsequently died. The earliest date of death in the series was 1917; 10 died before 1950, 33 between 1950 and 1959, and the remaining 40 in the past four and a half years. The youngest patient died at the age of 33, and nearly half were dead before the age of 55 (Table 1).

Clinical Features

The ward notes of 65 of the patients were available and give a picture of a disease with a consistent symptomatology. Among those with pleural

ST0279216

TABLE 1

AGE AT DEATH OF 45 PATIENTS WITH MESOTHELIAL TUMOURS

Age	Male		Female	
	No.	%	No.	%
40-49	2	4.5	1	2.4
50-59	1	2.2	6	14.3
60-69	1	2.2	9	21.4
70-79	10	24.4	18	42.9
80-89	1	2.2	8	19.0

tumours, the commonest presenting symptom was the rapid onset of extreme shortness of breath due to the formation of a massive pleural effusion. Pain was a prominent feature, either described as a dull ache, sometimes due to invasion of the ribs or vertebrae, or sometimes sharp and radiating, suggesting nerve involvement. Tumours in the chest wall were not uncommon, occurring either in previous operation scars or by direct invasion of the chest wall. The symptomatology of the peritoneal tumours was more varied. In some patients the presenting symptom was pain on defaecation or micturition. Diffuse upper abdominal pain was very common, and swelling of the abdomen due to ascites was always present terminally. The methods of treatment included pneumonectomy, decortication of the lung, deep x-ray therapy, instillation of radioactive gold, and cytotoxic drugs. They were used alone or in combination but had little effect on the course of the disease. Half of the patients suffering from pleural mesothelioma died within one year of the onset of symptoms, a further third within two years, and only one patient survived for more than three years. The course of those with peritoneal tumours appeared to be equally rapid. Eight of the patients died within six months of the onset of symptoms.

Sources of Information on Occupation and Residence

In addition to the ward notes, some of which gave good occupational histories, there were three other sources of information: the patient's general practitioner, the records of an asbestos factory in the area; and personal interviews with patients or their surviving relatives.

As a first step, general practitioners were circulated with an explanatory letter asking them to complete a form giving details of the occupations of patients and their immediate relatives. Within two months 65% of the doctors had replied. In two cases a history of end-on exposure to asbestos was revealed; in others the name and address of a surviving relative were given, but in the majority the doctor was unable to give information because, on the death of the

patient, the notes had been returned to the local executive council of the National Health Service, where they were destroyed within a period of three years.

In one of the asbestos factories a file was kept with detailed records of all employees since it started in 1913. The names of all patients were checked with these files. Nine men and nine married women (after their maiden names had been ascertained from relatives) were identified without difficulty. The exact dates of employment of these 18 patients and the jobs they had done were obtained from the records of the factory.

The four patients alive at the beginning of the investigation were interviewed personally. A few relatives were contacted by post, but the relatives of 68 patients were interviewed by one of us (H.T.) at their homes situated mostly in the East End of London. Not only was an occupational history of the patient, the spouse, sons and daughters, and father taken, but past addresses were also recorded. The interviews lasted for at least an hour. To recall events of 30 or 40 years ago it was often necessary to explore the residential and occupational histories of all members of the family.

Exposure to Asbestos in Three Groups of Patients Suffering from Other Diseases

For comparison with the mesothelioma patients, three further groups of patients suffering from other diseases were investigated.

The first group was selected from the patients in the medical and surgical wards of the hospital during the early summer of 1964 ('in-patient' series). Each patient in the mesothelioma series who had been traced was matched with an in-patient of the same sex born in the same five-year period. As there was a dearth of male patients over 75 years of age in the hospital, a sample of six patients of this age and older was taken from a neighbouring geriatric hospital.

The second group were those who had originally been filed in the pathology department of the hospital as cases of mesothelioma but in whom the diagnosis was subsequently rejected on pathological grounds by Hourihane (1964) ('rejected series'). As it had proved extremely difficult to locate the relatives of those who died before 1950, attempts were made only to trace the three survivors in this group and the 14 who died after 1950.

The in-patient series, already described, were all admitted to hospital in 1964. The patients with mesothelioma were admitted to the same hospital over a period of 47 years during which there might have been a substantial change both in the residential

MESOTHELIOMA

areas and social classes. London Hospital. The date of admission was taken from the date of admission as with the patients in the places of residence and for comparison with the

R.

Details of the 83 patients are given in the series about past domestic and available for seven patients 76, 40 (52.6%) gave a history compared with only nine series (Table 2). The difference

TYPES OF EXPOSURE WITH MESOTHELIOMA

Type of Exposure

Employed at one asbestos factory	Delivered goods to factory
Employed at other asbestos factories	Insulators and luggers
Relative worked with asbestos	Dockers handling asbestos cargo
No history of work or domestic exposure to asbestos	

Positive exposures to asbestos positive histories in in-patient series

*Seven cases of mesothelioma from this table.

statistically highly significant (0.001). This result is supported by the two groups of patients year of admission to the significant difference either or in the occupations of and those admitted before comparing the confirmed mesothelioma group with of the confirmed and in gave a history of exposure. This difference is statistically significant ($\chi^2 = 11.83$; $P < 0.001$).

returned to the local General Health Service, with a period of three

months a file was kept with records since it started in 1950. Records were checked with married women (after ascertained from relatives). The exact date of patients and the names from the records

the beginning of the 1950s. A few patients, but the relatives of one of us (H.T.) at the East End of London. End of occupational history of the daughters, and father also recorded. The hospital records were often necessary to occupational histories of

Three Groups of Patients for Diseases

mesothelioma patients, suffering from other

from the patients in the 'in-patient' series. Each series who had been dependent of the same period. As there was 15 years of age in the patients of this age and neighbouring 'geriatric

who had originally Department of the hospital in whom the (based on pathological 'treated series'). As to locate the relationship (195), attempts were made in this group

described, were all the patients with the same hospital in which there might be in the denial

areas and social classes of patients attending the London Hospital. Thus, a third group of patients was taken from the hospital records matched by date of admission as well as date of birth and sex with the patients in the mesothelioma series. Their places of residence and occupations were extracted for comparison with those of the in-patient series.

Results

Details of the 83 patients in the mesothelioma series are given in the Appendix. No information about past domestic and occupational histories was available for seven patients. Among the remaining 76 (91.6%) gave a history of exposure to asbestos compared with only nine (11.8%) of the 'in-patient' series (Table 2). The difference in this proportion is

TABLE 2

TYPE OF EXPOSURE TO ASBESTOS IN 76 PATIENTS WITH MESOTHELIOMA AND 76 IN-PATIENTS WITH OTHER DISEASES

Type of Exposure	Mesothelioma Series		'In-patient' Series	
	No.	%	No.	%
Exposure at one asbestos factory	14	18.4	1	1.3
Exposure at two or more asbestos factories	4	5.3	1	1.3
Asbestos and ladders	8	10.5	4	5.3
Asbestos worked with asbestos	9	11.8	1	1.3
Asbestos handling asbestos	0	—	2	2.6
No history of work or domestic exposure to asbestos	36	47.4	67	88.2

Ratio of exposure to asbestos in mesothelioma series versus other diseases in in-patient series

$$\chi^2 = 27.11; P < 0.001$$

*Seven cases of mesothelioma could not be traced and are omitted from this table.

statistically highly significant ($\chi^2 = 27.11; P < 0.001$). This result is unlikely to be unduly influenced by the two groups of patients not being matched for year of admission to hospital, since there was no significant difference either in the areas of residence or in the occupations of the patients admitted in 1964 and those admitted between 1917 and 1964. Comparing the confirmed and rejected patients in the mesothelioma group who died after 1950, 36 (50%) of the confirmed and none of the 17 rejected cases gave a history of exposure to asbestos (Table 3). This difference is statistically highly significant ($\chi^2 = 11.83; P < 0.001$).

TABLE 3

EXPOSURE TO ASBESTOS OF CONFIRMED AND REJECTED CASES OF MESOTHELIOMA SURVIVING AFTER JANUARY 1950

Exposure to Asbestos	Diagnosis of Mesothelioma	
	Confirmed	Rejected
Exposure positive	36	0
No work or domestic contact traced	35	16
Untraced	1	1

$$\chi^2 = 11.83; P < 0.001$$

Mesothelioma Series

Occupational Exposures.—There are details available for the 18 mesothelioma patients who had worked at one asbestos factory which used crocidolite asbestos with small amounts of chrysotile and first introduced amosite in 1926. Eleven started work before 1933 (the year when the asbestos regulations controlling the manufacture of asbestos goods and the protection of asbestos workers became effective), and seven started work between the beginning of 1933 and the end of 1942. The occupations of these workers and the type of asbestos they used are shown in Table 4. All of the 17 for whom details were available had used crocidolite asbestos. Five of the occupations listed are not scheduled as

TABLE 4

JOBS OF 17 PATIENTS WITH MESOTHELIOMA EMPLOYED AT ONE ASBESTOS FACTORY

Statutory Obligations	Job	Male	Female	Material
Subject to regulations	Spinning	0	4	Crocidolite
	Carding	1	1	Crocidolite
	Clothing and weaving	1	0	Crocidolite, chrysotile, amosite
	Disintegrating and opening	2	1	Crocidolite, chrysotile, amosite
Not subject to regulations	Filter making for A.R.P. masks	2	0	Crocidolite
	Manufacturing of preformed pipe insulation	1	1	Crocidolite
	Manufacturing of brake linings	1	0	Crocidolite
	Rubber compounding	0	1	Crocidolite, chrysotile
	General labourer	1	0	Crocidolite, chrysotile, amosite

*Employment history not available for one female patient.

ST0279218

MESOTHELIOMA OF PLEURA FOLLOWING EXPOSURE TO ASBESTOS 265

IN THE IN-PATIENT

No. of Patients	No. with Exposure to Asbestos
21	1
9	0
5	2
6	2
3	0
14	1
11	1
76	9

is in the in-patient occupational exposure to asbestos dust.

more than one-fifth of the employed, opened in the nearer the centre of seven years. There were only living within half a mile of the time it was in production. At the present time living within a half-mile of the factory and remained at the factory. The other seven were children when the factory was 23 years of age and until she died 48 years later. One patient who had neither exposure but in whom asbestos bodies were found at necropsy. One patient lived near the site and four others lived near the site. One patient was 22 years of age when he was exposed in 1915. One patient, complained of the asbestos factory.

NO OCCUPATIONAL OR EXPOSURE TO ASBESTOS

Age at First Exposure (years)	Total
21	1
22	1
23	1
24	1
25	1
26	1
27	1
28	1
29	1
30	1
31	1
32	1
33	1
34	1
35	1
36	1
37	1
38	1
39	1
40	1
41	1
42	1
43	1
44	1
45	1
46	1
47	1
48	1
49	1
50	1
51	1
52	1
53	1
54	1
55	1
56	1
57	1
58	1
59	1
60	1
61	1
62	1
63	1
64	1
65	1
66	1
67	1
68	1
69	1
70	1
71	1
72	1
73	1
74	1
75	1
76	1
77	1
78	1
79	1
80	1
81	1
82	1
83	1
84	1
85	1
86	1
87	1
88	1
89	1
90	1
91	1
92	1
93	1
94	1
95	1
96	1
97	1
98	1
99	1
100	1

Thus, among those with no occupational or domestic exposures to asbestos, there are 11 (30.6%) patients in the mesothelioma series and five (7.6%) patients in the in-patient series who lived within half a mile of an asbestos factory in the area (Table 6). The difference in the proportion of patients in the two series who lived in the vicinity of the factory and had had no other exposure to asbestos is statistically significant ($\chi^2 = 7.85; P < 0.01$).

Date of First Exposure and Interval Before Death in Mesothelioma Series.—Fifty-one men and women had been exposed to asbestos, including those who lived near the main asbestos factory. The duration of exposure varied widely, ranging from two months to over 50 years. The interval between the first exposure and death varied between 16 and 55 years (mean 37.5 years). Among the group of factory workers, where exposure was probably heaviest, the interval was shortest. It was longest among the group living in the neighbourhood of the asbestos factories, where exposure to dust was probably lowest. Table 7 shows the mean age of each group at first exposure and the mean of the interval before death in each group. Although the length of interval

TABLE 7

RELATION BETWEEN TYPE OF EXPOSURE AND LENGTH OF INTERVAL BEFORE DEATH IN 51 PATIENTS IN MESOTHELIOMA SERIES

Type of Exposure	No.	Mean Age at First Exposure (years)	Mean Interval between First Exposure and Death (years)
Factory workers	21	22.5	29.4
Domestic workers and insulators	9	17.9	31.9
Living in neighbourhood of asbestos factories	11	15.4	38.6

varied between 29.4 and 48.6 years, the mean age at death showed less variation; it was 50.6 years in the group of factory workers and between 55 and 57 years in the other groups.

Asbestos Bodies and Asbestosis in the Mesothelioma Series.—Of the 83 patients in the mesothelioma series, lung tissue was available for examination in forty-three. In four other patients, all certified as suffering from asbestosis, with no lung tissue available, examination of sputum during life revealed the presence of asbestos bodies (Table 8). Both asbestos bodies and histological evidence of asbestosis were found in 15 of the 24 factory workers and ladders. A further five showed evidence of either asbestos bodies or asbestosis.

Lung tissue was available in only four patients exposed either through relatives or by living in the neighbourhood of asbestos factories. In two, asbestos bodies were present in lung tissue but there was no evidence of asbestosis.

TABLE 8

EVIDENCE OF ASBESTOS BODIES OR ASBESTOSIS IN 47 CASES OF MESOTHELIOMA WITH LUNG TISSUE OR SPUTUM AVAILABLE FOR EXAMINATION

History of Contact with Asbestos	Asbestosis or Asbestos Bodies		Lung Tissue not Available
	Present	Absent	
Positive	22	6	23
Negative	4	3	13
Untraced	4	3	0
Total	30	17	36

Among the 12 patients in whom no definite contact with asbestos could be established, there was one, a merchant seaman from South Africa, whose lungs showed both asbestos bodies and asbestosis; he may have had contact either in South Africa or at sea, but his early history could not be established. There were three others in this group who had asbestos bodies in lung tissue without evidence of asbestosis.

Of the seven patients whose histories could not be traced, three had asbestos bodies and histological evidence of asbestosis and one had asbestosis alone.

Discussion

In the mesothelioma series there are 25 patients in whom no evidence of any exposure to asbestos could be found. A chief source of information was a history taken from a surviving relative. A surprising amount of information was obtained, but in some of those interviewed the memory may have been defective or they may not have known of short periods of exposure during the youth of the deceased. For example, one of the patients was eventually identified as having worked at a large asbestos factory for two months in 1941. This was before he married, and his widow did not know of this episode. It is of interest that asbestos bodies in the lungs were found in only four of this group, and it seems probable that among the remainder there were those who had had no exposure to asbestos.

In the mesothelioma series of patients, both in industrial and non-industrial exposures were recognized. Among the men the exposure was predominantly industrial; 22 worked in asbestos factories or as ladders, two were exposed at home and one lived near the asbestos factory. Among the women only 10 worked in asbestos factories, and

ST0279220

further 17 had non-industrial exposures, seven in the home and 10 living near asbestos factories.

There is no evidence that the patients with peritoneal tumours differed in their type of exposure from the patients with pleural tumours. The proportion of positive findings of asbestos bodies or asbestos was similar in both groups. A higher proportion of women, particularly among the factory workers, was affected by peritoneal tumours, but the difference between the sexes was not statistically significant.

The recent increase in the number of patients diagnosed at the hospital may be partly due to an increased interest in mesothelial tumours and partly to the long interval between first exposure and development of the tumour. Those exposed between 1915 and 1925 might be expected to die from about 1950 onwards. Asbestos imports to the United Kingdom have mounted steeply since 1932 (Leathart, 1964) and its uses are more widely diversified in industry. The increasing proportion of the population exposed to asbestos during the past 30 years may be expected to give rise to an increasing occurrence of mesothelial tumours.

The choice of groups for comparison with the mesothelioma series of patients was not ideal. The number of patients it was possible to trace in the 'retreated' series proved to be very small. The 'in-patient' series, although matched for date of birth and sex, differed from the mesothelioma series in that all were admitted to hospital during 1964. Neither of these groups could be interviewed without knowledge of the disease from which they were suffering. This could have led to bias with under-reporting of exposure to asbestos in the in-patient series. However, in the 'in-patient' series the actual patient was interviewed, and more detailed and reliable histories were obtained than was possible from the relatives of those who had died of mesothelial tumours. There was no evidence that, because of their more recent admission to hospital, the in-patient series was less

likely than the mesothelioma series to work in contact with asbestos or to live in closer proximity to asbestos factories.

There seems little doubt that the risk of mesothelioma may arise from both occupational and domestic exposures to asbestos. Wagner and others (1960) described patients with no exposure other than living as a child in the vicinity of the asbestos mines. A high incidence of asbestos plaques of the pleura has been found in the population living near an anthophyllite mine in Finland (Kiviluoto, 1960). More evidence is required of an increased risk to the population living in the neighbourhood of asbestos factories or other areas, such as dockyards, where asbestos is used in quantity.

We should like to thank Dr. D. O'B. Hourihane for his co-operation and for making the results of his investigations available to us.

Our thanks are also due to Professor C. Wilson, Professor V. W. Dix, Dr. N. L. Rush, and Mr. G. Flavell, F.R.C.S., of the London Hospital and Dr. C. P. Silver of St. Matthew's Hospital for permission to interview their patients; to the general practitioners who collaborated in this enquiry; to the managements of the asbestos factories for arranging access to their records; to Miss Joan Wallford for statistical assistance, and to Dr. J. C. Gilson, Professor R. S. F. Schilling, and Dr. W. Smither for their advice and help.

The contents of this paper were communicated to the Conference on the Biological Effects of Asbestos, arranged by the New York Academy of Sciences in October 1964, and will be published in a shorter form in the proceedings of that conference.

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Appendix opposite

Case No.	Site of Primary Tumour	Sex
Section A: Factory workers		
8	Pleura	M
19	Peritoneum	M
18	Peritoneum	F
24	Pleura	M
14	Peritoneum	F
16	Peritoneum	F
13	Peritoneum	
11	Peritoneum	
15	Peritoneum	
9	Peritoneum	
21	Pleura	
12	Peritoneum	
5	Peritoneum	
7	Peritoneum	
2	Pleura	M
20	Peritoneum	F
17	Pleura	F
6	Pleura	M
10	Peritoneum	F
1	Pleura	M
23	Pleura	M
3	Peritoneum	M
4	Peritoneum	M
Section B: Luggers and others		
25	Pleura	M
28	Pleura	M
22	Pleura	M
30	Pleura	M
27	Peritoneum	M
26	Peritoneum	M
31	Pleura	M
29	Pleura	M

ST0279221

MESOTHELIOMA OF PLEURA FOLLOWING EXPOSURE TO ASBESTOS 267

APPENDIX EIGHTY-THREE PATIENTS WITH MESOTHELIAL TUMOURS

Case No.	Site of Primary Tumour	Sex	Year of Birth	Year of First Exposure	Duration of Exposure (years)	Year of Death	How Diagnosed	Asbestos Bodies in Lung Tissue	Pathological Evidence of Asbestos in Lung Tissue	Survival from Initial Symptoms (months)	Relevant History
Section A: Factory workers											
1	Pleura	M	1901	1921	17	1938	Necropsy	Positive	Positive	7	Brake liner, boiler coverer, asbestos factory; mainly crocidolite
2	Pleura	M	1895	1919	22	1941	Necropsy	Positive	Positive	7	Disintegrator and other jobs, asbestos factory; amosite, crocidolite, chrysotile
3	Pleura	M	1895	1919	22	1941	Necropsy	Positive	Positive	7	Sectional pipe maker, asbestos factory, certified asbestos; mainly crocidolite
4	Pleura	F	1908	1925	5	1947	Biopsy	Positive (sputum)	N/A	9	Used asbestos boarding in railway carriage construction
5	Pleura	M	1830	1928	12	1950	Necropsy	Positive	Negative	9	Asbestos factory, job unknown
6	Pleura	F	1893	1917	4	1951	Necropsy	Negative	Negative	7	Opener and sectional pipe maker, asbestos factory, certified asbestos; amosite, crocidolite, chrysotile
7	Pleura	F	1906	1922	7	1951	Biopsy	Positive (sputum)	N/A	7	Spinner, asbestos factory, certified asbestos; mainly crocidolite
8	Pleura	F	1894	1915	5	1955	Necropsy	Positive	Positive	12	Sectional pipe maker, asbestos factory, certified asbestos; mainly crocidolite
9	Pleura	F	1895	1917	1	1955	Biopsy	Positive (sputum)	N/A	3	Spinner, asbestos factory, certified asbestos; mainly crocidolite
10	Pleura	F	1901	1918	11	1955	Biopsy	Positive (sputum)	N/A	6	Disintegrator, asbestos factory; amosite, crocidolite, chrysotile
11	Pleura	F	1897	1919	1	1956	Necropsy	Positive	Negative	3	Asbestos mixer, north England
12	Pleura	M	1893	1928	1	1957	Biopsy	N/A	N/A	18	Asbestos factory, mainly crocidolite
13	Pleura	F	1918	1937	2	1958	Biopsy	N/A	N/A	18	Carder, asbestos factory; mainly crocidolite
14	Pleura	F	1918	1937	2	1958	Necropsy	Positive	Positive	18	Clutch and weaving, asbestos factory; amosite, crocidolite, chrysotile
15	Pleura	M	1908	1927	30	1958	Necropsy	Positive	Positive	18	Filter maker for A.R.P. masks, asbestos factory; mainly crocidolite
16	Pleura	M	1925	1940	4	1958	Biopsy	N/A	N/A	3	Filter maker for A.R.P. masks, asbestos factory; mainly crocidolite
17	Pleura	M	1925	1941	16	1959	Biopsy	Negative	Negative	11	Electrode coverer, crocidolite
18	Pleura	F	1907	1921	10	1959	Necropsy	Negative	Negative	7	Spinner, asbestos factory; mainly crocidolite
19	Pleura	F	1908	1924	1	1962	Biopsy	Positive	Negative	7	Delivered chemicals to asbestos factory; amosite, crocidolite, chrysotile
20	Pleura	M	1907	1942	10	1962	Necropsy	Positive	Positive	7	Spinner, asbestos factory; mainly crocidolite
21	Pleura	F	1899	1923	11	1963	Biopsy	Positive	Negative	5	Labourer, works and buildings, asbestos factory; amosite, crocidolite, chrysotile
22	Pleura	M	1899	1936	26	1963	Necropsy	Positive	Positive	7	Worked in yard of insulating contractors
23	Pleura	M	1908	1925	1	1963	Necropsy	Positive	Negative	8	Carder, asbestos factory; mainly crocidolite
24	Pleura	M	1911	1930	2	1963	Necropsy	Positive	Positive	6	Disintegrator and other jobs, asbestos factory; amosite, crocidolite, chrysotile
25	Pleura	M	1917	1937	27	1964	Necropsy	Positive	Positive	24	Disintegrator and other jobs, asbestos factory; amosite, crocidolite, chrysotile
Section B: Lathers and insulators											
26	Pleura	M	1874	1888	53	1935	Necropsy	Negative	Negative	12	Worked in close proximity to boiler repainer in dockyards
27	Pleura	M	1893	1910	22	1935	Biopsy	N/A	N/A	24	Boiler cleaner and stripper, dockyards
28	Pleura	M	1921	1917	22	1959	Necropsy	Positive	Positive	9	Boiler coverer and lagger to various firms
29	Pleura	M	1921	1917	22	1959	Necropsy	Positive	Positive	9	Erecting and fitting central heating
30	Pleura	M	1908	1922	39	1961	Biopsy	N/A	N/A	25	Boiler coverer and pipe insulator, contracting firm
31	Pleura	M	1908	1922	36	1961	Necropsy	Positive	Positive	12	Lagger and boiler coverer, various firms
32	Pleura	M	1911	1927	34	1961	Necropsy	Positive	Positive	13	Intermittently boiler lagger, ship repairs
33	Pleura	M	1927	1916	41	1962	Biopsy	N/A	N/A	8	Installation of hospital sterilizing equipment
34	Pleura	M	1912	1927	34	1962	Biopsy	N/A	N/A	10	

ST0279222

(continued)

APPENDIX (continued)

EIGHTY-THREE PATIENTS WITH MESOTHELIAL TUMOURS

Case No.	Site of Primary Tumour	Sex	Year of Birth	Year of First Exposure	Duration of Exposure (years)	Year of Death	How Diagnosed	Asbestos Bodies in Lung Tissue	Pathological Evidence of Asbestosis in Lung Tissue	Survival from Initial Symptoms (months)	Relevant History
<i>Section C. Exposure of relatives</i>											
40	Pleura	M	1912	1925	11	1956	Biopsy	N/A	N/A	27	Elder sister worked as spinner at asbestos factory; died 1946, certified asbestotic.
34	Pleura	F	1913	1919	2	1957	Biopsy	N/A	N/A	14	Elder sister employed as spinner; looked after patient as child.
38	Pleura	F	1895	1919	41	1960	Biopsy	N/A	N/A	15	For several years husband worked in ship's engine room, close proximity to lagging operations.
37	Pleura	F	1905	1925	14	1960	Biopsy	N/A	N/A	3	Husband worked as boiler coverer; overalls brought home for washing.
35	Peritoneum	F	1890	1921	21	1960	Necropsy	Positive	Negative	34	Husband foreman and executive at asbestos factory.
33	Pleura	F	1916	1930	4	1961	Necropsy	Negative	Negative	7	Husband a docker; frequently handled 'white' asbestos.
39	Pleura	M	1919	1928	2	1961	Biopsy	N/A	N/A	18	Elder sister worked as spinner at asbestos factory and suffers from asbestosis.
32	Pleura	F	1900	1941	5	1963	Biopsy	N/A	N/A	18	Daughter worked in asbestos factory for 5 years; patient washed her overalls.
36	Peritoneum	F	1899	1912	18	1963	Biopsy	N/A	N/A	15	Husband railway carriage builder; lined compartments with asbestos sheeting; work clothes washed at home.
<i>Section D. Neighbourhood cases</i>											
44	Pleura	F	1905	1913	7	1959	Biopsy	N/A	N/A	8	Lived within 1 mile of present site of asbestos factory.
48	Pleura	M	1922	1922	16	1960	Biopsy	N/A	N/A	17	Lived within 1 mile of present site of asbestos factory.
42	Pleura	F	1889	1913	48	1961	Biopsy	Positive	Negative	15	Lived within 100 yards of present site of asbestos factory.
50	Pleura	F	1903	1908	6	1961	Biopsy	N/A	N/A	13	Lived within 1 mile of old site of asbestos factory.
43	Pleura	F	1905	1913	13	1961	Biopsy	N/A	N/A	4	Lived within 1 mile of present site of asbestos factory.
47	Pleura	F	1917	1917	10	1961	Biopsy	N/A	N/A	16	Lived within 200 yards of present site of asbestos factory.
64	Pleura	F	1899	1907	6	1962	Biopsy	Negative	Negative	5	Lived within 1 mile of old site of asbestos factory.
71	Pleura	F	1899	1907	6	1962	Biopsy	N/A	N/A	12	Lived within 1 mile of old site of asbestos factory.
41	Pleura	F	1900	1913	32	1962	Biopsy	N/A	N/A	29	Lived within 1 mile of present site of asbestos factory.
45	Pleura	F	1900	1913	7	1962	Biopsy	N/A	N/A	9	Lived within 1 mile of present site of asbestos factory.
46	Pleura	F	1907	1913	7	1963	Biopsy	N/A	N/A	7	Lived within 1 mile of present site of asbestos factory.
<i>Section E. No history of contact with asbestos</i>											
49	Pleura	F	1900			1947	Necropsy	Positive	Negative	7	Worked as nursemaid to manager of gas works in East London; asbestos insulation used in water.
40	Peritoneum	F	1902			1954	Necropsy	Negative	Negative	5	Shorthand-typist and housewife; lived Hildon area.
45	Pleura	M	1895			1954	Biopsy	N/A	N/A	7	Baker's roundman, army, general labourer, publican for 30 years in East End of London.
76	Pleura	F	1899			1955	Biopsy	N/A	N/A	7	Munitions work before marriage; then housewife; lived Waltham Abbey, Essex.
74	Peritoneum	F	1914			1955	Necropsy	Negative	Negative	27	Tailor and housewife in East End of London.
62	Pleura	M	1899			1955	Necropsy	Negative	Positive	28	Employed as luteman and greaser, Beckton gas works 26 years; persistent discharging sinus R side of chest following emphysema 1925; acute chest infection 1953; subsequent intracranial abscess had deteriorated from this date.

Case No.	Site of Primary Tumour	Sex	Year of Birth
61	Peritoneum	M	1891
54	Pleura	M	1894
76	Pleura	F	1899
38	Pleura	M	1895
66	Pleura	F	1905
57	Peritoneum	M	1895
32	Pleura		
63	Pleura		
51	Pleura		
59	Pleura		
73	Pleura		
70	Pleura		
72	Peritoneum	F	
55	Pleura	M	1895
60	Peritoneum	M	1891
67	Pleura	F	1894
56	Pleura	M	1891
69	Peritoneum	F	1895
53	Pleura	M	1895
<i>Section F. Unrelated cases</i>			
78	Pleura	F	1891
83	Pleura	M	1894
81	Pleura	M	1895
80	Pleura	M	1894
82	Pleura	M	1894
77	Peritoneum	F	1895
79	Pleura	F	1895

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APPENDIX (continued)

EIGHTY-THREE PATIENTS WITH MESOTHELIAL TUMOURS

No.	Site of Primary Tumour	Sex	Year of Birth	Year of First Exposure	Duration of Exposure (years)	Year of Death	How Diagnosed	Asbestos Bodies in Lung Tissue	Pathological Evidence of Asbestosis in Lung Tissue	Survival from Initial Symptoms (months)	Relevant History
1	Pleurothorax	M	1913			1955	Biopsy	N/A	N/A	8	Merchant seaman, cargoes from S. Africa 1930-32, no definite evidence of contact with asbestos; subsequently employed on cross-channel boats
2	Pleura	M	1904			1956	Biopsy	N/A	N/A	12	Labourer and builder, finally employed in tunnelling; lived in East End of London
3	Pleura	F	1916			1957	Biopsy	N/A	N/A	19	Employed remaking old sacks in Bow, previous content of sacks not ascertained; lived East End of London
4	Pleura	M	1891			1957	Biopsy	N/A	N/A	11	Garage hand, chauffeur, mechanic, lived Wulverhampton and Lipping
5	Pleura	F	1898			1958	Biopsy	N/A	N/A	6	Worked as printing machinist before marriage, then as housewife until death; lived East End of London
6	Pleurothorax	M	1879			1958	Biopsy	N/A	N/A	3	Stereotyper and printer, lived originally in East London, then moved to Ipswich
7	Pleura	M	1890			1959	Biopsy	N/A	N/A	12	Van boy, regular army, cutter and grinder; lived N.E. London and Dagenham
8	Pleura	M	1904			1960	Biopsy	N/A	N/A	18	Bricklayer, cement worker, postman; lived East End of London, moved to Hainault, Essex in 1931
9	Pleura	M	1910			1960	Necropsy	Negative	Negative	18	Fitter and turner; lived principally in East End of London
10	Pleura	M	1911			1960	Necropsy	Positive	Positive	?	Coloured S. African merchant seaman, stoker at glass factory; possible contact with asbestos in S. Africa or at sea
11	Pleura	F	1887			1962	Necropsy	Negative	Negative	10	Lived until marriage in Wales, then housekeeper in S.W. London
12	Pleura	F	1888			1962	Biopsy	Negative	Negative	30	Machinist in celluloid collars, housewife and canteen worker; lived East London
13	Pleurothorax	F	1898			1962	Biopsy	N/A	N/A	10	Machinist in hosiery trade, Nottingham, housewife; moved to London 1960
14	Pleura	M	1888			1962	Necropsy	Negative	Negative	2	Labourer, merchant seaman, docker, carried only meat
15	Pleurothorax	M	1915			1962	Necropsy	Negative	Negative	54	Apprentice printer, barman, cook, and butcher. For 25 years before death lived East End of London
16	Pleura	F	1897			1963	Biopsy	N/A	N/A	29	Dressmaker and housewife; lived East End of London then S.W. London
17	Pleura	M	1912			1963	Biopsy	N/A	N/A	24	Steel erector, army, steel erector, labourer and porter; lived East End of London
18	Pleurothorax	F	1901			1964	Necropsy	Negative	Negative	42	Employed as packer in pharmaceutical firm for 12 years, then housewife until death; lived in Dagenham
19	Pleura	M	1892			1964	Necropsy	Positive	Negative	24	Fisherman, fireman, docker, 1915-39 at Tilbury docks, fireman and finally storekeeper; contact with asbestos not probable at Tilbury docks; lived Tilbury area
Group F. Untraced cases											
20	Pleura	F	1893			1917	Necropsy	?	Positive		Not traced
21	Pleura	M	1860			1922	Necropsy	Negative	Negative		Not traced
22	Pleura	M	1877			1925	Necropsy	Negative	Negative		Not traced
23	Pleura	M	1900			1936	Necropsy	Negative	Negative		Not traced
24	Pleura	M	1893			1938	Necropsy	Positive	Positive		Not traced
25	Pleurothorax	F	1910			1945	Necropsy	Positive	Positive		Not traced
26	Pleura	F	1878			1955	Necropsy	Positive	Positive		Not traced

N/A = tissue not available.

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