Abnormalities Consistent with Asbestos-Related Disease Among Long-Term Demolition Workers

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The Center to Protect Workers' Rights (CPWR) — the research and development arm of the Building and Construction Trades Department, AFL-CIO — is uniquely situated to serve workers, contractors, and the scientific community. A key CPWR activity is to improve safet and health in the U.S. construction industry. This report is part of that effort and was developed through a subgrant between CPWR and Mount Sinai School of Medicine as part of a CPWR/NIOSH cooperative agreement. Federal monies spent on this project: $28,172 (1991).

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Contents

The demolition environment and the health consequences of the hazards encountered during demolition work have received relatively little attention in the occupational medicine literature. While acute trauma has been recognized as a serious problem for demolition workers, there has been much less focus on occupational illnesses for which demolition workers may be at increased risk.

Asbestos is contained in many materials used in construction and therefore potentially encountered during demolition — for instance, thermal insulation, fireproofing, acoustical insulation, and decorative surfacing, and as a binder in roofing papers and floor tiling. During the renovation or demolition of industrial, commercial, and residential structures, these materials can be disturbed, generating aerosols of dust containing respirable asbestos fibers and placing those on site at risk of asbestos-related disease.

Anecdotal information obtained during clinical evaluations of individual patients suggested that demolition workers earlier had frequent occasion to disturb asbestos-containing materials, especially in earlier decades and most often without the use of respiratory protection. It is for this reason that the researchers investigated the prevalence of asbestos-related disease among long-term demolition workers.

Methods and Population

The workers who participated in this study were members of Local 95, Laborers' International Union of North America, a union local in New York City whose members specialize in demolition work. Because asbestos-related diseases have a long latency and generally appear only twenty or more years after the onset of exposure, the union was asked to prepare a list of members (and retirees) who had joined the demolition local more than twenty years earlier. Invitations for examination were extended to 355 individuals, and 88 workers chose to be examined.

The examinations were conducted from Sept. 14, 1991 through June 3, 1992 at the Mount Sinai - I.J. Selikoff Occupational Health Clinical Center, in New York City. The data collected included lifetime occupational, medical, and smoking histories; respiratory questionnaires; a review of symptoms; a physical examination; chest X-ray films (postero-anterior and lateral views); and spirometric pulmonary function tests adhering to current American Thoracic Society guidelines.

X-rays were interpreted using the International Labour Office-1980 classification. Films were read by Dr. Ruth Lilis (an experienced B reader recently recertified by the National Institute for Occupational Safety and Health).

Onset of Exposure

To rule out potential exposures to asbestos apart from demolition work, it was important to obtain information about other trades these men had worked in and experience in the military that may have entailed exposure to asbestos. Thus all examinees were asked if they had ever worked in construction (other than as demolition workers), in a shipyard, in brake repair, as merchant marine seamen, as insulators, or in any other occupation where they may have been exposed to asbestos.

Forty-eight (55 percent) of those examined had worked in another potentially exposed trade or had military service aboard ship where exposure to asbestos may have occurred (table 1).

Asbestos-related scarring of the lung parenchyma and pleural surfaces are latent diseases, requiring at least 15, and more often 20 to 25 years from the onset of exposure before changes are detectable on chest X-ray or on pulmonary function testing. It was important, therefore, to focus the investigation on those whose exposure to asbestos began at least 20, and preferably more than 30, years earlier.

For individuals whose only reported exposure to asbestos occurred during demolition work, the onset of exposure for each was said to be the year the subject began demolition work. For those who had worked in other trades with potential exposure to asbestos or had possible exposure in the military, onset of exposure to asbestos was said to have begun at the earliest date when such activity began.

Most of those examined — 76 percent — had begun exposure to asbestos at least 35 years earlier (table 2). Only 10 (11.4 percent) had first been exposed less than 25 years earlier.

Smoking History

Twenty-three (26 percent) of those examined had never smoked cigarettes; 43 (49 percent) were ex-smokers, and 22 (25 percent) were still smoking at the time of examination (table 3). This distribution is comparable to what has been found in studies of other building trades workers.

Chest X-Ray Findings

Among the 88 who underwent chest X-ray examination, 19 (22 percent) exhibited changes on their X-rays consistent with prior asbestos exposure (table 4). In three of the positive cases, small, irregular opacities compatible with parenchymal fibrotic changes (scarring of the lung tissue) were noted, while in 17 cases, pleural abnormalities

(scarring of the lining of the lung and/or chest wall) were found. Pleural and parenchymal changes were found in combination in only one case.

The number of participants with fewer than 35 years since onset of exposure was too small to permit an analysis of the relationship of the prevalence of radiographic abnormalities to the time since beginning work with asbestos. Of the 67 examinees exposed 35 or more years earlier, 15 (22 percent) had such abnormalities on their chest X-rays.

X-Ray Findings and Smoking Status

Ex-smokers had the highest frequency of changes on the chest X-rays (28 percent, table 5), followed in prevalence by current smokers (23 percent). Only 9 percent of those who had never smoked showed such abnormalities.

Examinees with Exposure to Asbestos Only as Demolition Workers

To attempt to assess the effect of work in demolition on chest X-ray findings, the radiographic results for those examinees (n=40; 45 percent) who reported no other occupational (or military service) exposure to asbestos other than as demolition workers were compared with those who had other potential exposures to asbestos. Very little difference in the results of chest X-ray examination could be demonstrated between the two groups (table 6).

Pulmonary Function Test Results

Of the 87 examinees who performed pulmonary function testing, 63 (72 percent) were normal (table 7). One individual could not undergo testing because of an orofacial deformity.

The predominant abnormality was a restrictive pattern, defined as a forced vital capacity (FVC) less than 80 percent of predicted (for age, race, sex, and height). This reflects an inability to fill the lungs with a normal volume of air, and can occur in cases of lung scarring.

FEV_1 is the volume of air exhaled in the first second (forced expiratory volume). The FEV_1/FVC ratio measures how fast air moves through the large airways. Only two subjects had a pure obstructive abnormality, defined as FEV_1/FVC — less than 80 percent of predicted with an FVC 80 percent of predicted or greater. Obstructive patterns result from narrowing of the airways, often due to chronic inhalation exposure to airborne irritants, including cigarette smoke.

Three examinees had combined obstructive-restrictive abnormalities, where the FVC and the FEV_1/FVC ratio are both less than 80 percent of predicted.

When pulmonary function test results were compared with smoking history, ex-smokers had the highest prevalence of abnormality — 37 percent compared with a 27 percent rate among current smokers (table 8). This is consistent with what has been found in other studies; the tendency for individuals who experience respiratory symptoms associated with reduced pulmonary function to stop smoking likely contributes to this association.

The presence of findings on chest X-rays consistent with asbestos-related scarring was associated with abnormality on pulmonary function testing (table 9). Fifty-four (79 percent) of 68 examinees with normal chest X-rays had normal pulmonary function tests. Only nine (47 percent) of the 19 individuals with abnormal chest X-rays exhibited normal pulmonary function. This difference was found entirely in the rates of restrictive abnormalities. For those with normal films, the rate of restrictive change was 12/68 (18 percent); for those with X-ray abnormalities, the rate was 10/19 (53 percent). None of the subjects with abnormal chest X-rays had a purely obstructive pulmonary function pattern.

There was little difference in the rates of abnormal pulmonary function between those who reported having worked around asbestos only as demolition workers (12/39, 31 percent) and those who had other occupational exposure to asbestos (12/48, 25 percent) (table 10).

Conclusions

Although this study involved a small group, it provides evidence that demolition workers have been exposed to asbestos — reflected in the prevalence of changes on chest X-ray (22 percent) among those with 35 or more years since beginning demolition work. (A number of studies have shown that the background rate of such findings on X-rays consistent with asbestos-related scarring is less than 2 percent among groups not known to have had asbestos exposure.)[1] Rates of abnormality on chest X-rays were unaffected by whether exposure occurred only during demolition or in other occupational (or military) settings as well. A history of having smoked was associated with an increased likelihood of chest X-ray abnormality, the great majority involving pleural thickening (scarring of the lining of the lung and/or chest wall).

[1]For instance, see R.M. Castellan, W.T. Sanderson, and M.R. Petersen, Prevalence of radiographic appearance of pneumoconiosis in an unexposed blue-collar population. *Am. Rev. Resp. Disease*, 131(1985): 684-86.

Restrictive abnormalities on pulmonary function testing were found in half of those with radiographic abnormalities. Again, a history of cigarette smoking was associated with pulmonary functional abnormality.

These results show that demolition workers as a group have had significant exposure to asbestos in the course of their work. Prevention of exposure to asbestos among active demolition workers is necessary to prevent adding to the future burden of asbestos-related disease.

Regulations requiring removal of asbestos-containing materials in place before renovation or demolition begins have reduced exposure in recent years. Nonetheless, exposures to asbestos dust continue, because removal of such materials is not always done or is often incomplete, at best. To prevent recurrent episodes of exposure, demolition workers must be trained to recognize situations having potentially hazardous exposures. Medical monitoring of demolition workers for asbestos-related scarring lung disease and the cancers associated with asbestos exposure would also appear to be warranted.

Table 1. Exposure to asbestos other than in demolition

Exposure other than in demolition	Number of workers	Percent
No	40	45
Yes	48	55
Total	88	100

Table 2. Number of years since onset of exposure to asbestos

Years	Number of workers	Percent
1-19	5	6
20-24	5	6
25-29	4	4
30-34	7	8
35-39	32	36
40+	35	40
Total	88	100

Table 3. Smoking status

Smoking status	Number of workers	Percent
Smokers	22	25
Never smokers	23	26
Ex-smokers	43	49
Total	88	100

Table 4. Abnormalities on chest X-ray

Type of abnormality	Number of workers	Percent
None	69	78
Parenchymal only	2	2
Parenchymal + pleural	1	1
Pleural only	16	18
Total	88	99

Table 5. Abnormalities on chest X-ray by smoking status

	Smoking status			
Chest X-ray abnormalities	**Smokers: n(%)**	**Ex-smokers: n(%)**	**Never-smokers: n(%)**	**Total n(%)**
None	17(77)	31(72)	21(91)	69(78)
Parenchymal only	0	2(5)	0	2(2)
Parenchymal + pleural	0	1(2)	0	1(1)
Pleural only	5(23)	9(21)	2(9)	16(18)
Total	22(25)	43(49)	23(26)	88(100)

Table 6. Abnormalities on chest X-ray by history of exposure to asbestos other than in demolition

Chest X-ray abnormalities	No other exposure: n(%)	Other exposure: n(%)	Total abnormalities: n(%)
None	32(80)	37(77)	69(78)
Parenchymal only	2(5)	0	2(2)
Parenchymal + pleural	0	1(2)	1(1)
Pleural only	6(15)	10(21)	16(18)
Total	40(45)	48(55)	88(100)

Table 7. Pulmonary function test results

Results	Number of workers	Percent
Normal	63	72
Restrictive only	19	22
Obstructive only	2	2
Restrictive + obstructive	3	4
Total	87	100

Note: Test data are missing for one worker.

Table 8. Pulmonary function test results by smoking status

	Smoking status			
Pulmonary test results	**Smokers: Number % smokers**	**Ex-smokers: Number % ex-smkrs**	**Never-smokers: Number % nvr-smkrs**	**Total n(%)**
Normal	16 73%	27 63%	20 91%	63(72)
Restrictive only	5 23%	12 28%	2 9%	19(22)
Obstructive only	0	2 5%	0	2(2)
Restrictive + obstructive	1 5%	2 5%	0	3(4)
Total (%)	22(25)	43(49)	22(26)	87(100)

Note: Test data are missing for one worker.

Table 9. Pulmonary function test results by X-ray appearance

	Chest X-ray abnormalities				
Pulmonary test results	**None: n, %**	**Parenchymal only: n, %**	**Parenchymal + pleural: n, %**	**Pleural only: n, %**	**Total n, %**
Normal	54 79%	1 50%	0	8 50%	63 72%
Restrictive only	11 16%	1 50%	1 100%	6 38%	19 22%
obstructive only	2 3%	0	0	0	2 2%
Restrictive + obstructive	1 1%	0	0	2 12%	3 4%
Total	68 78%	2 2%	1 1%	16 18%	87 100%

Note: Test data are missing for one worker.

Table 10. Pulmonary function test results by history of exposure to asbestos other than in demolition

Pulmonary test results	No other exposure: n(%)	Other exposure: n(%)	Total workers n(%)
Normal	27(69)	36(75)	63(72)
Restrictive only	9(23)	10(21)	19(22)
Obstructive only	2(5)	0	2(2)
Restrictive + obstructive	1(3)	2(4)	3(3)
Total	39(45)	48(55)	87(100)

Note: Test data are missing for one worker.