

Survey on the Mortality from Malignant Tumors of Female Asbestos Spinning Workers

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Abstract

Objective:

To investigate the mortality from malignant tumor of female workers involved with the manual spinning of asbestos.

Methods:

A retrospective cohort study on the causes of death was conducted.

Results:

It was found that a total of 144 persons died of cancer. The mortality from malignant tumor of the workers was 108.97 per hundred thousand people per year. Among the malignant tumors, lung cancer was placed in the top rank with mortality up to 56.00 per hundred thousand people per year. Compared with the control population of the same region, the SMR from total malignant tumor and lung cancer of workers was 1.16 ($P<0.05$) and 4.17 ($P<0.01$), respectively.

Conclusion:

A high incidence of lung cancer may also occur among female workers who are exposed to chrysotile.

For human beings, exposure to asbestos dust will not only lead to lung fibrosis but also induce lung cancer, mesothelioma and cancers in other parts of body. Since the 1970s, the international cancer research institutions have included asbestos as one of the carcinogens for human beings. In 1987, China's Ministry of Health listed lung cancer and mesothelioma caused by asbestos as occupational-related cancers and classified them as legal occupational diseases. Cixi city of Zhejiang Province is one of the asbestos processing bases in China. It has a history of asbestos processing covering around 40 years (since 1960). In order to investigate the issue of cancer risk

in the manual asbestos spinning industry, we conducted a survey and research on 5681 female manual asbestos spinning workers in Cixi city for information on death caused by tumors. A report is given as below.

1 Materials and methods

1.1 Survey sample

A valid survey candidate was defined as a woman working on the manual spinning of asbestos in a family home over one year between January 1, 1960 and December 31, 1980. A simple random sampling method was used; seven towns and 43 villages were selected as survey spots. Finally, 5681 female workers were selected, by a simple random sampling method according to their numbers in the census register, as the survey object population in our investigation. The follow-up visits were ended on December 31, 1996. Averages of female age and mortality in Cixi City from 1990 to 1996 were adopted as the standard control population.

1.2 Survey methods

The retrospective cohort study method was used with follow-up visits for 5681 female manual asbestos spinning workers in 43 villages. According to the standard survey questionnaire, the issues of occupational history, diagnosis of pneumoconiosis, family cancer history, smoking history and drinking behavior of female workers were investigated. For workers who could not be found in the period of investigation, a family visit would be done. In the case of death, the cause of death and the recorded date of diagnosis and of death, would be confirmed. The causes of death were categorized according to International Categories of Disease (ICD-9) and malignant tumors were diagnosed according to Level-III Diagnosis Standard (Level-I cell pathological diagnosis, Level-II X ray examination or other physical diagnosis, Level-III clinical diagnosis). The recorded results should be as precise as possible.

1.3 Information and data processing method

All information from female workers was collected and the database created by computer. SPSS/PC+ software was used to calculate the mortality rate, standard mortality rate (SMR, relative risk (RR) and attributable risk (AR).

2. Results

2.1 General hygienic information

The asbestos processing industry in Cixi city began in 1960 and was the first such business in Zhejiang. At that time, there were many small workshops in every village. The working conditions were bad and the concentration of asbestos dust was very high there, as high as 38.00-73.00mg/m³ around spinning machines. In 1967, a simple plastic cover for dust prevention was introduced in manual spinning processing. This measure proved useful and the concentration of asbestos dust decreased significantly (approximately 2mg/m³). The plastic cover was suitable for the small workshops in

rural areas. Since 1970, manual asbestos spinning had been dispersed to households. The workers were all females aged from 15-68 years. They worked on manual spinning for 6-8 hours a day and 150-200 days a year. The concentration of asbestos dust in major places of household manual spinning processing was (1.25 ± 0.73) mg/m^3 ; the quality conformity rate of the samples was 84.27% (75/89). The highest polluted spot was around the manual spinning-machine itself (average $1.78 \text{ mg}/\text{m}^3$), then the dining area ($1.02 \text{ mg}/\text{m}^3$); the lowest was in the bedroom ($0.72 \text{ mg}/\text{m}^3$).

2.2 Categories of cancer-caused death

The follow-up visit for female manual asbestos spinning workers continued for 37 years. The number of observed person-years was 132149yr. Among them, there were 144 persons who had died of malignant tumors. The number of people in Level-I and Level-II diagnosis was 8 and 130, respectively. The accurate rate was 95.83% and mortality rate 108.98/100,000. Among them, lung cancer was the main cause. Among lung cancer cases, there were 4 cases of epidermoid carcinoma, 2 cases of adenocarcinoma and 2 cases of undifferentiated carcinoma according to histological examination. The other malignant tumors were liver cancer and stomach cancer. Mesothelioma cases were not found in our investigation (See Table 1).

Table 1. Cancer-caused mortality rate and proportion for female manual asbestos spinning workers

Sites of tumors	Number of Deaths	Mortality rate (1/100,000)	Proportion (%)
Lung cancer	74	56.00	51.39
Liver cancer	27	20.43	18.75
Stomach cancer	18	13.62	12.50
Intestine cancer	7	5.30	4.86
Carcinoma of esophagus	6	4.54	4.17
Cervical Cancer	3	2.27	2.08
lymph cancer	3	2.27	2.08
mammary cancer	2	1.51	1.39
Leukemia	1	0.76	0.69
Kidney cancer	1	0.76	0.69
melanoma	1	0.76	0.69
pheochromocytoma	1	0.76	0.69
Total	144	108.97	100

2.3 Situation of lung cancer episode and mortality

During the cohort study, we found 74 cases of lung cancer. All of them had died. The mortality rate was 56.00/100,000. The average latent period of lung cancer was 26.27 years (18.00-33.67 years). The average age of becoming ill with lung cancer was 59 years (30-84 years). The average time of exposure to asbestos dust was 17 years (9-23 years).

2.4 SMR, RR and AR in comparison to all cancers and lung cancer

Comparing female manual asbestos spinning workers with the control population, we found that the RR and AR of all cancer death and lung cancer death are higher than the control group ($P < 0.05$ or $P < 0.01$) (See Table 2). SMR for all cancer did not have significances ($P > 0.05$) compared with the control group, but SMR for lung cancer showed a statistical significance (99% CI: 3.03-5.59) (See in Table 3).

Table 2. RR and AR of malignant tumor and lung cancer of female manual asbestos spinning workers

	Mortality rate of the observation group	Mortality rate of the control group	RR	AR (1/100,000)
All cancer death	108.97	94.27	1.16*	14.70*
Lung cancer death	56.00	13.42	4.17**	42.58**

Note: compared with the control group, * $P < 0.05$, ** $P < 0.01$

Table 3. SMR of malignant tumor and lung cancer of female manual asbestos spinning workers

	Number of actual mortalities	Number of estimated mortalities	SMR	95%CI
All cancer death	144	124.57	1.16	0.975-1.36
Lung cancer death	74	17.73	4.17	3.28-5.24

3. Discussion

3.1 Asbestos and lung cancer

It was reported in China that malignant tumor was the first cause of death of workers in the asbestos industry, in which, lung cancer accounted for the greatest proportion^[1-3]. Wang Zhiming et al. traced 1472 workers from asbestos mines for 15 years and found that the mortality rate from malignant tumor for workers from asbestos mines was significantly higher than that for workers from coal mines (SMR 1.43) and lung cancer SMR 5.72. Demen^[4] and his colleagues traced workers from the asbestos textile industry of South Carolina, U.S. for 15 years and found that the SMR of lung cancer in female workers was 2.75, which was significantly higher than the control group. Takahashi and his colleagues^[5] traced 528 male workers and 192 female workers from an asbestos product factory of Liaoning, China for 25 years and found the mortality rate of all cancers and lung cancer of male workers significantly increased (SMR 1.6 and 2.1). The same situation occurred for the female workers. We have traced and observed 5681 female manual asbestos spinning workers for 37 years

and found the mortality rate of all cancers and lung cancer increased significantly: the SMR was 1.16 and 4.17, respectively. The results were basically coincident with the records of archives. Though the concentration of asbestos dust was low in Cixi city, the research result indicates that the manual spinning of asbestos may lead to high risk of lung cancer for those exposed.

3.2 Asbestos and malignant tumors in other sites

It is universally considered that asbestos is a carcinogen. Lung cancer, mesothelioma and intestinal cancer of the observation group are all significantly higher than for the general population^[5]. Zhang Huaqiang et al.^[6] undertook a cohort study on 530 workers from Qingdao asbestos factory and found that stomach cancer rates in male workers were significantly higher than the standard (SMR 787.40, $P < 0.01$). The research results of Wang Zhiming indicated that cancer of larynx and other cancers occurring in workers exposed to asbestos did not have a distinctive relationship with the fact of exposure to asbestos. This article indicates that besides lung cancer developing in female manual asbestos spinning workers, other cancers such as liver cancer and stomach cancer could also develop; however, compared with the control population, these were not statistically significant ($P > 0.05$). It needs more epidemiological study to confirm the relationship between exposure to asbestos and tumors at other sites.

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