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The significance of non-occupational asbestos exposure in women with mesothelioma

Nonhlanhla Tlotleng[1,2], Kerry Sidwell Wilson[1,2], Nisha Naicker[1,2,3], Coenraad FN Koegelenberg[4], David Rees[1,2] & James Ian Phillips[1,5]

[1]National Institute for Occupational Health, National Health Laboratory Services, Johannesburg, South Africa.
[2]School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, South Africa.
[3]Department of Environmental Health, Faculty of Health Sciences, University of Johannesburg, South Africa.
[4]Department of Medicine, Faculty of Medicine and Health Sciences, Stellenbosch University, South Africa.
[5]Department of Biomedical Technology, Faculty of Health Sciences, University of Johannesburg, South Africa.

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Correspondence
Nonhlanhla Tlotleng, National Institute for Occupational Health, National Health Laboratory Services, Johannesburg, South Africa. E-mail: nonhlanhla.tlotleng@nioh.nhls.ac.za

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Abstract

Malignant mesothelioma is a rare and aggressive pleural or peritoneal tumour almost always caused by exposure to asbestos fibres. Exposure to asbestos can cause malignant mesothelioma 30–40 years after exposure. A description of sources of exposure is important for prevention and possible financial compensation. Three women with cases of histologically confirmed malignant mesothelioma diagnosed from non-occupational asbestos exposure are described. Patients were contacted for an interview to assess their exposure history to asbestos. All three cases had mixed exposure histories related to secondary, environmental contamination, and domestic exposure. This case series highlight how ubiquitous asbestos is in the environment and how diverse the exposures may be. It is anticipated that a significant number of cases of non-occupational mesothelioma will be seen in many countries for several decades given the extent of asbestos containing materials.

Introduction

Due to its negative impact on health, a number of countries have banned the use of asbestos [1]. In South Africa, the Department of Labour has requirements for working with asbestos products in the Asbestos Regulations, published in 2002 [2], and in 2008 the Department of Environmental Affairs and Tourism prohibited the use, manufacture, and processing of asbestos [3]. The statute, as is the case in many countries, does not apply to asbestos containing materials already in place, such as roofing sheets. Strict control measures are prescribed for working on, maintenance, and removal of asbestos products, but the risk of inhaling asbestos fibres still exists, through environmental contamination and domestic exposure.

Asbestos and asbestos products were commercially used for many purposes as asbestos has useful properties. For example, asbestos containing materials were widely used in wall and roofing sheets, gutters, pipes, insulation, and ceiling and floor tiles. These materials are still found in homes and workplaces today. Historically, exposure occurred most commonly by coming into contact with asbestos fibres while at work. Secondary asbestos exposure occurred when fibres were brought home on contaminated work clothes or other workplace articles. Environmental exposure is from unremediated land contaminated by industrial activities such as mining, milling, and transport of asbestos or manufacturing of asbestos products such as asbestos cement. Another source, one of growing concern, arises from living or working in structures with damaged asbestos cement materials (ACMs) or from disturbance of ACMs while repairing, renovating, or demolishing [4].

Inhalation of asbestos fibres can cause malignant mesothelioma of the pleura, which typically manifests 30–40 years after first exposure, with longer periods possibly seen with lower levels of exposure [5]. Malignant mesothelioma of the pleura affects the tissue surrounding the lungs. The tumour does not respond to therapeutic

modalities and most patients die within a year of diagnosis. A sex difference in asbestos-related mesothelioma cases has been reported. The rates of women with mesothelioma are lower than those of men as more men than women were exposed through their occupations [6].

Cases of malignant mesothelioma are still being reported in South Africa in individuals who worked with asbestos or lived in the vicinity of asbestos mines and mills. Non-occupational exposure from domestic sources such as aged and weathered construction materials containing asbestos may result in exposure sufficient to cause disease. Therefore, non-occupational sources of asbestos exposure need to be assessed in South African mesothelioma patients with no obvious occupational or environmental exposure. In this report, we highlight three cases of mesothelioma in women with diverse environmental exposures.

Case Series

Methods

We obtained exposure histories from adult patients (≥18 years of age) who were diagnosed with malignant mesothelioma during July 2017–December 2017 in public hospitals in South Africa, where no direct occupational exposure was present. The histology reports of the consenting patients were reviewed by a pathologist to confirm the diagnosis. Informed consent from the patients was obtained by attending clinicians prior to contacting the patient for an interview to assess their history of exposure to asbestos.

In one case where domestic exposure was suspected, an occupational hygiene assessment was conducted. An accredited occupational hygiene company was approached to do an inspection and collect samples of material used in the construction of the house. The samples were sent to the South African National Institute for Occupational Health for analysis. Scanning electron microscopy (SEM) with energy dispersive spectrophotometry (EDS) was used to identify asbestos fibres.

Results

Case 1

A 70-year-old woman initially presented with pleuritic chest pain and dyspnoea and was found to have a moderate right-sided effusion with minimal pleural thickening (Fig. 1). Closed pleural biopsy confirmed malignant mesothelioma. She had worked in an office at an asbestos mine from 1971 to 1972. She reported not having worked with asbestos or touching asbestos. While working at the mine, she and her family had lived in one of the mine houses that were provided for the staff. She reported that the mine houses had asbestos cement roofs. Her husband worked in the asbestos mine for a period of 15 years (1960–1975) and was diagnosed with asbestosis in 1999. She indicated that she drove her husband to work and that she would stop at the mills, where if there was heavy wind she was exposed to large amounts of dust from the asbestos mills and that she would have to brush it off her clothes. She hand washed her husband's dusty clothes during the entire period he worked at the mine. Her father and brothers had also worked on the asbestos mine and were also diagnosed with asbestosis.

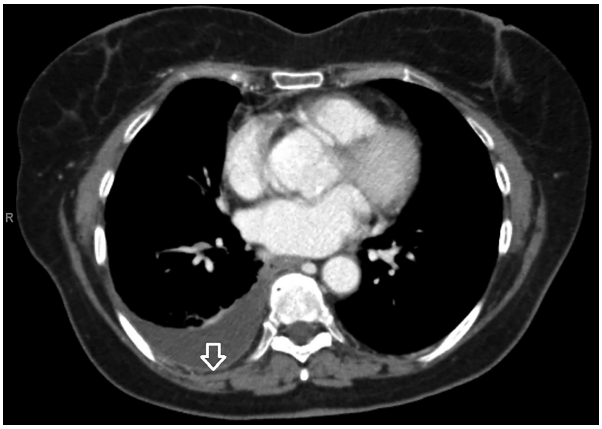

Figure 1. A computed tomography scan of patient 1 showing a moderate right-sided effusion with mild diffuse pleural thickening (arrow).

Case 2

A 69-year-old woman experienced intermittent severe chest pain for over 5 years prior to being diagnosed with mesothelioma by means of a medical thoracoscopy. She had a large right-sided effusion (Fig. 2) at the time of the thoracoscopy. The patient lived near a Power Station from 1948 to 1969, where her father worked. She reported that she could not recall where she would have been exposed to asbestos, and after further questioning she mentioned that the power station was close to their home and had boiler pipes right in front of their home. She also recalled playing at the power station as a child. She remembered that if it was a windy day, the dust would blow all over their house. She moved away from her home town when she was 21 years old. She had worked at a bank from 1968 to 1970. She then worked for a bus company in 1970 until her retirement. She reported never having worked with asbestos or touching asbestos-containing materials, neither had she worked in a place where asbestos was used. Thus the only identified source of possible exposure was from the power station, structures which typically had large quantities of asbestos, primarily for insulation.

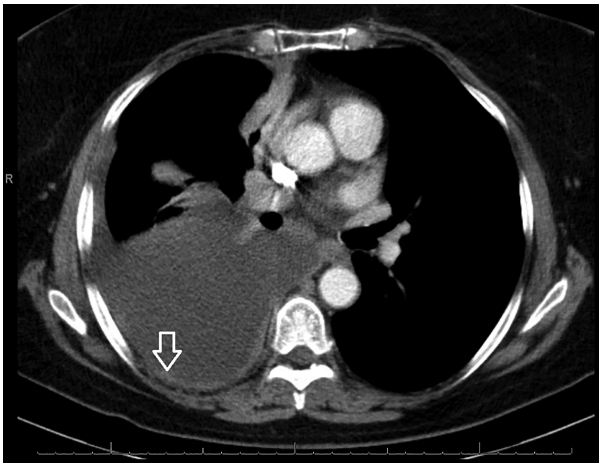

Figure 2. A computed tomography scan of patient 2 demonstrating a large right-sided effusion with pleural nodules (arrow).

Case 3

A 58-year-old woman presented with long-standing left-sided chest pain and weight loss. She was found to have profound circumferential pleural thickening on imaging (Fig. 3), and a cutting needle biopsy confirmed the presence of a mesothelioma. She reported never working with asbestos and neither had she worked in a place where asbestos was used. She worked in an undergarment factory using sewing machines, which have been known to contain asbestos. She lived near an asbestos cement plant until 1998. She indicated that the house she grew up in was a municipality house with no ceiling but was unsure about the nature of the roof. When questioned about any other asbestos exposure she might have had, she indicated not being sure and she answered no to living with someone who has worked with asbestos. An occupational hygiene assessment was conducted on materials of her childhood dwelling. During the inspection, it was noted that renovations had been made to her house. Samples of the waste from the renovations that were kept in the yard were sampled for analysis for asbestos fibres.

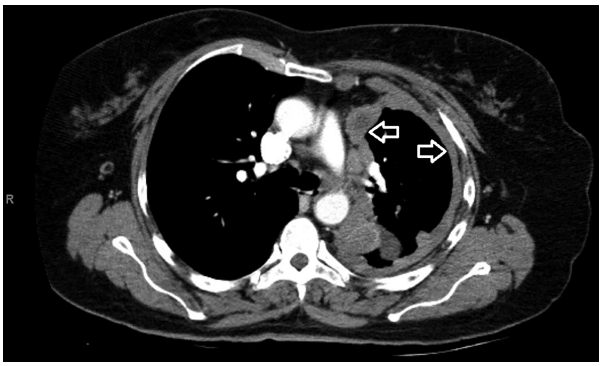

Figure 3. A computed tomography scan of patient 3. Note the impressive circumferential and mediastinal pleural thickening (arrows), with constriction of the left hemithorax.

SEM analysis of the windowsills, downpipes, and the waste from building renovations kept in the yard showed fibres with an aspect ratio greater than 3:1 characteristic of asbestos fibres. EDS analysis confirmed the presence of crocidolite and chrysotile asbestos fibres in the samples. The cement roof tiles on the house did not contain asbestos; however, during the occupational hygiene assessment, it was noted that most of the houses around the neighbourhood contained asbestos roof sheets. There is also a school located across from her house that had asbestos-containing water tanks and an asbestos roof.

Discussion

Despite the banning of asbestos, it is anticipated that a significant number of cases of mesothelioma will be seen in South Africa and many other countries for many decades. This is due to the long lag phase of the disease and the continued ubiquitous use of asbestos in the country. While occupational asbestos exposure is often reported as a common source of exposure to asbestos materials, non-occupational asbestos exposure is generally less reported and appreciated by clinicians. These cases all had multiple sources of asbestos exposure, secondary sources, environmental contamination, and domestic exposure. Malignant mesothelioma of the pleura occurs more commonly in men than in women and this is due to occupational exposures. Historically, women were officially excluded from a number of occupations commonly associated with asbestos exposure [7]. Non-occupational exposure occurs predominantly in women [8]. The three cases presented here echo the analysis of female mesothelioma cases in Italy where the important role of non-occupational exposure was shown [6]. With the cessation of asbestos mining, milling, and manufacturing of asbestos-containing products it is expected that occupationally acquired cases of mesothelioma will decline. However, the potential for multiple occupational and non-occupational exposures to asbestos is still present due to unremediated, contaminated environments and ubiquitous, asbestos-containing materials extant in buildings and structures. Through such exposures we can expect to continue to see cases of malignant mesothelioma of the pleura in South Africa despite the banning of asbestos 10 years ago.

Disclosure Statement

This study was approved by Stellenbosch University (ethics reference number: 0660), and Human Research Ethics Committee (medical) University of the Witwatersrand (ethics reference: M170235).

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