

# Case report: peritoneal mesothelioma from asbestos in hairdryers

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**Background:** The relationship between mesothelioma and exposure to asbestos is well established. As a result, the use of asbestos in buildings, construction sites, and mines, as well as the implications of disease for the workers has received considerable attention. However, asbestos was also used in household equipment and consumer products, including hairdryers.

**Purpose:** To examine one case of peritoneal mesothelioma in a hairdresser and review the relevant literature on asbestos exposure from hairdryers.

**Methods:** The subject's medical and occupational records were obtained and reviewed and a physical examination was performed.

**Results:** The results indicate that the subject developed peritoneal mesothelioma from her occupational exposure to asbestos containing hairdryers in accordance with the literature.

**Conclusion:** Hairdryers are possible sources of asbestos exposure in patients with mesothelioma, and the asbestos exposure risk is higher for those who use hairdryers occupationally.

**Keywords:** Asbestos, chrysotile, hairdryer, hairdressers, peritoneal mesothelioma, low-level exposure, occupational exposure

## Introduction

Asbestos is a mineral belonging to the group of fibrous silicates. Due to its resistance to high temperatures and low cost, it is used in products needing to withstand high temperatures.<sup>1,2</sup> Asbestos was widely used in the manufacturing of household equipment and consumer products, including appliances, car brakes, clothing, irons, and electric blankets. Asbestos was also used in hairdryers as insulation to diminish the fire hazard.

Wagner *et al.* reported the association between asbestos exposure and mesothelioma in 1960.<sup>3</sup> The publication is widely cited as establishing the causative link between asbestos exposure and mesothelioma, although there had been several previous case reports of pleural cancer in subjects with asbestosis. Additional studies and reports have confirmed that asbestos exposure causes mesothelioma.<sup>4-7</sup> In 1979, the U.S. Consumer Product Safety Commission (CPSC) issued a recall of hairdryers and other salon accessories containing asbestos. Although no longer manufactured, hairdryers containing asbestos were likely in use in the United States through the early 1980s. The risk associated with hairdryer use during this time was highest for hairdressers, due to daily

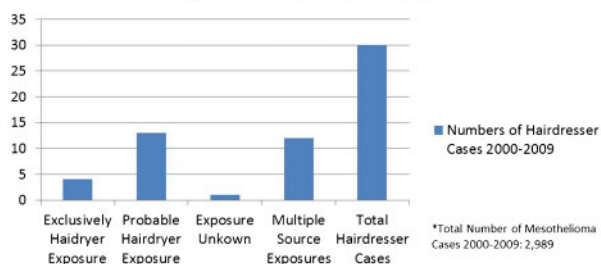
asbestos exposure resulting from close proximity to the fibers released from the dryer. This report presents and discusses a case of peritoneal mesothelioma in a hairdresser whose only documented asbestos exposure was to asbestos containing hairdryers.

## Background: Asbestos in Hairdryers

The CPSC regulates hazardous consumer products under The Federal Hazardous Substances Act. Asbestos was used as an insulator in the hood-type and the hand-held blow dryers during the 1970s and early 1980s.<sup>8</sup> Ninety percent of hairdryer manufacturers used asbestos as an insulator during this time (OSHA, See Appendix 1 for full list). Most manufacturers voluntarily stopped using asbestos in their models in 1980 after the National Institute for Occupational Safety and Health (NIOSH) released a study in 1979 about asbestos release. The NIOSH study found that the number of asbestos fibers emitted from hairdryers at 0 to 0.11 structures/cm<sup>3</sup> was a significant health threat.<sup>9</sup> This finding was sufficient to halt production and distribution of asbestos containing hairdryers. The study also noted that the flow rate of hand-held blow dryers was up to 2 m<sup>3</sup>/min, ample to force asbestos fibers into the environment and providing opportunity for fiber inhalation. Additionally, the degradation of hairdryer asbestos linings with age was another source of airborne exposure.

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### Number of Mesothelioma Cases in Hairdressers by Reported Source of Exposure (2000-2009)



**Figure 1** Data derived for review from Carugno *et al.* and the Lombardy Mesothelioma Registry.<sup>11</sup> From 2000 to 2009, four cases were certainly hairdryer exposure, 13 cases were possible exposure, 1 “hair-washer” was listed as unknown, and 12 hairdresser cases had reported other asbestos exposure sources.

The Lombardy Mesothelioma Registry in Italy tracked 2 989 mesothelioma cases from 2000 to 2009. A total of 30 malignant mesothelioma cases were reported in hairdressers (see Fig. 1). By defining criteria (see Appendix B) to evaluate asbestos exposure from hairdryers, researchers identified four cases whose only documented occupational asbestos exposure was asbestos containing hairdryers.<sup>10</sup> They also identified 13 cases of probable asbestos exposure in hairdressers. Twelve additional mesothelioma cases were identified among hairdressers, but all had other occupational exposure to asbestos. Individuals performing maintenance on hairdryers were also likely exposed to asbestos. While no data currently exists on the number of exposed individuals, some hairdressers from the Lombardy Mesothelioma Registry reported manually removing the old and crumbly asbestos protections.

## Case Report

### Health history

A 49-year-old female was evaluated in May 2004 for a routine Papanicolaou smear. As a result of decreased bone density, she was referred to a rheumatologist. A blood test revealed an elevated sedimentation rate, prompting a work-up for malignancy including a computed topography (CT) of the abdomen. There were no reports in her medical records of abdominal abnormalities on physical examination. Radiological studies revealed multiple lesions in the abdominal cavity, leading to an exploratory laparotomy, revealing several masses in the peritoneal cavity. The largest was a 7-cm mass adherent to the splenic flexure of the colon. Other lesions were noted adjacent to the stomach, intestine, diaphragm, omentum, liver, and adrenal gland. Specimens labeled “epigastric mass,” “left splenic colon,” “peritoneum,” “omentum,” “right tube and ovary,” and “left tube and ovary” were submitted to

pathology for microscopic and immunocytochemistry analysis. Sections revealed an epithelial malignancy exhibiting a spectrum of differentiation consistent with well-differentiated malignant mesothelioma. Large and small irregular glandular spaces lined by small mesothelial-like epithelial cells focally on the peritoneal surfaces were essentially indistinguishable from benign hyperplastic mesothelium. The histology revealed a poorly differentiated malignant neoplasm with epithelial and mesothelial expression. Salient mesothelioma immune-histological markers were positive including CAM 5.2, EMA, Calretinin (a marker of mesothelial cells), and CD5 (a marker positive in mesothelioma). The CA 125 was normal at 19 and the clinical picture and histology were not indicative of ovarian cancer. She was diagnosed with peritoneal mesothelioma in August 2004. The patient underwent surgical debulking and chemotherapy treatment with cisplatin and Alimta<sup>®</sup>. In April of 2005, she had a second cycle of chemotherapy with Alimta. The tumor responded to chemotherapy. After treatment, the patient was inactive with impaired memory, emotional distress, insomnia, nausea, loss of appetite, and frequent pain. Her symptoms were typical of peritoneal mesothelioma.<sup>12</sup> The patient had a history of smoking cigarettes for 20 years, but had no serious health problems prior to her cancer diagnosis. She died in late 2006. Radiology studies of her chest were not read by a B-reader, but one CT revealed diaphragmatic scarring.

### Occupational history

The subject worked as a cosmetologist and makeup artist in New York from 1976 to 1992 and used a hairdryer every day. She worked 8–14 hours a day, 4–5 days a week, not altering the products she used between 1976 and 1985. The patient used a blow dryer 1–2 feet away from her face, close enough to feel the expulsion of hot air from the dryer. She reported that the air was strong enough to blow her hair and bangs away from her face. The hairdryer was on and off throughout the day, in use for periods of 15–20 minutes for 8–14 hours a day, 4–5 days a week. The patient only used the models of hairdryers that contained asbestos (Conair, General Electric, Gillette) from 1976 to 1982. A new hairdryer was purchased every year as a result of burned out motors. The patient used hairdryers until 1992, a total of 16 years.

The subject was involved in a legal case in which the defendant ruled out any other asbestos exposures. The subject experienced no exposure from relatives working in the asbestos industry. An evaluation on her residence and job histories also revealed no asbestos exposure. She lived in New York, New York; West Hartford, Connecticut; and Santa Monica, California. None of these locations were near an asbestos

factory, mine, or erionite area. Outside of her career as a cosmetologist and makeup artist, the subject worked behind a deli counter and in beauty supply sales. Neither occupation exposed her to asbestos.

## Discussion

We present one of the few documented cases of mesothelioma as the result of exposure to asbestos containing hairdryers. No other asbestos exposure was identified for this patient and smoking history is not associated with the development of mesothelioma.<sup>13</sup> The first exposure to asbestos for this subject occurred in 1976 and it well established that mesothelioma has a long latency.<sup>14,15</sup> Her exposure was daily and intermittent, between 15 and 30 minutes/ hour. According to her description of work, the hairdryer discharged asbestos fibers into her breathing zone daily.

Geraci *et al.* found 30 hairdryer models emitted fibers in mass concentrations ranging from 0 to 7 652 ng/m<sup>3</sup> and 0–0.11 structures/cm<sup>3</sup>. In their calculations, Geraci *et al.* omitted total individual fibers in the bundles and clumps diminishing the value to 0.11 structures/cm<sup>3</sup> or less. There is a broad consensus in the literature that all types of asbestos fibers are carcinogens to human beings.<sup>6,16–20</sup> Mesothelioma can occur from brief exposures and at low doses.<sup>21,22</sup> There is no evidence of a threshold level of asbestos exposure in which there is no risk of mesothelioma.<sup>23</sup>

Asbestos release from hairdryers was discovered by accident when a photographer used a hairdryer to dry film and noted white flecks on the film. The CPSC issued a recall and convinced the manufacturers of hair dryers to voluntarily remove asbestos from this product [<http://www.cpsc.gov/en/newsroom/news-releases/1979/independent-analysis-for-cpsc-confirms-potential-health-threat-posed-by-asbestos-hair-dryers/>]. Asbestos was not banned [<http://www.ewg.org/asbestos/facts/fact4.php>]. These hairdryers were used through at least the early 1980s. In this case, exposure may have been limited to 4 years (1976–1980) but evidence indicates that this dose of asbestos was sufficient to cause mesothelioma.<sup>24,25</sup> The time elapsed between first exposure and the occurrence of mesothelioma was ~28 years. The mean latency for peritoneal mesothelioma is 28 years.<sup>26</sup> Peritoneal mesothelioma is sometimes associated with longer and heavier exposures.<sup>27,28</sup> Surgical removal and chemotherapy may slow the progress of mesothelioma, but there is no known cure.<sup>29</sup>

## Disclaimer Statements

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**Conflicts of interest** The corresponding author is sometimes retained as an expert in civil cases regarding exposure to asbestos. The law firm was not involved at all in the writing of the report, and it was not written for the purposes of litigation.

**Ethics approval** None.

## Appendix 1

Andis, Bonat Inc., Clairol, Conair Corp., Dominion Division of Scovill Manufacturing, General Electric Co., The Gillette Company, Hamilton Beach Division of Scovill Manufacturing, J.C. Penney, Korvette, Montgomery Ward & Co., Norelco, North American Philips Corp., Presto, Schick, Inc., Sears, Roebuck & Co., Sperry Rand Corp. (Remington), and Sunbeam Corp.

## Appendix 2

Review of criteria used to evaluate hairdresser exposure cases in Italy from Carugno *et al.*

1. Occupational exposure as certain if the MM cases reported that their personal hairdryers contained asbestos;
2. Occupational exposure as possible if the MM cases reported the use of hairdryers without giving information about their characteristics, for at least 1 year before asbestos was banned;
3. Exposure as unknown if the MM cases reported that they worked exclusively as “head-washer” and for a brief time-window (e.g. less than 1 year).

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