

Asbestos and Shipyards

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Abstract

1) Exposure to various types of asbestos has occurred in shipyards since the last two decades of the 19th century. In the 20th century the problem became severe, particularly in some countries with high shipbuilding activity. During the first half of the century, the UK was by far the most important producer, with the US having intense naval production during the two World Wars. The second half of the century was marked by the enormous rise of shipbuilding activity in Japan, and later in South Korea. Apart from the major producers, various countries, especially in Europe, showed important shipbuilding activity.

2) The features of asbestos exposure in shipyards may be reconstructed on the basis of studies conducted at necropsy. All people working in shipyards were involved. The intensity of exposure varied widely. In studies performed in the shipyard area of Monfalcone, Italy, pleural plaques were observed among shipyard workers in 80-90% of the cases. Plaques varied in size with 21.2% being small, 33.1% being moderate, and 32.4% large. Asbestos bodies were visible on routine lung sections in 35% of the cases. Isolation of asbestos bodies after chemical digestion of the lung showed burdens higher than 1,000/gram of dried tissue in 78.6% of the cases, and higher than 10,000/gram in 49.1%. Both chrysotile and amphiboles were detected in lungs, lymph nodes, and pleura from shipyard workers.

3) The geography of malignant mesothelioma reflects exactly the shipbuilding activity. The highest mesothelioma incidences have been reported from shipyard areas. For some decades exposure to asbestos has been stopped or reduced in the shipyards of various countries. However, exposure to different types of asbestos, including crocidolite, continued in many shipyards until a few years ago. This suggests that, among shipyard workers, a high mesothelioma incidence will be observed in the next decades too.

Different varieties of asbestos have been used in shipbuilding since the last decades of the 19th century¹. Consequently, people working in shipyards were exposed to these substances since the onset of the asbestos era. In the 20th century the problem became severe in countries with high shipbuilding activity. Several European countries and Japan had relevant naval production in the first half of the century, with the UK being by far the most important of them. In the USA shipbuilding was intense during the two World Wars, particularly in the WWII, when about 3 million people were employed in shipyards. The world panorama of shipbuilding changed completely in the second half of the 20th century. In this period ship production showed a dramatic increase in Japan, and later in South Korea. In comparison with these countries, shipbuilding was modest in other parts of the world.

Generally, the concentration of asbestos fibers in the various departments of the shipyards has not been explored. Nevertheless, the features of asbestos exposure that occurred in shipbuilding in the past century may be reconstructed on the basis of studies conducted at necropsy. A series of 3,640 consecutive necropsies have systematically been investigated for asbestos exposure markers in the Monfalcone shipyard area, Italy². In 1,277 of such cases detailed lifetime occupational histories were obtained. Persons who had worked at least for some periods in the shipyards, showed pleural plaques in 86.7% of the cases. In a subgroup of men, who had worked only in the shipyards, the percentage positive for pleural plaques rose to 93.4³. These figures suggest that all people employed in shipbuilding were exposed to asbestos. In fact, in some cases pleural plaques do not develop despite heavy exposures. In the Monfalcone studies, pleural plaques were classified into three classes: small (1-4 cm in major diameter), moderate (plaques measuring more than 4 cm in major diameter, but not involving more than 50% of a hemithorax), and large (plaques involving more than 50% of a hemithorax). Plaques moderate or large were found in 65.5% of shipyard workers; however, among workers of other industries the percentage of moderate-large plaques was only 14.6%. Since the size of the plaques is a reliable index of exposure intensity, the above data show that shipyard workers had exposures heavier than workers in other industries. Likewise, the prevalence of asbestos bodies in routine lung sections was 35.3% among shipyard workers, and 4.3% among people employed in other industries. Shipbuilding workers differed markedly from the other occupational groups, also in the amounts of lung asbestos bodies. Among shipyard workers isolation of asbestos bodies after chemical digestion of the pulmonary tissue showed burdens higher than 1,000 per gram of dried tissue in 78.6% of the cases, burdens higher than 10,000/gram in 49.1%, and higher than 100,000/g in 15.6%. The corresponding figures for the other industries were 31.5, 7.2, and 2.7%, respectively.

Different varieties of asbestos, including chrysotile and amphiboles, were detected in lungs, lymph nodes, and pleura from shipyard workers⁴. It is interesting that chrysotile and amphiboles showed a different distribution in the various tissues. Chrysotile fibers generally showed higher concentrations in the pleura than in the lungs. Moreover, in the pleura chrysotile burdens were higher than the amphibole amounts.

The relevance of the asbestos exposure that occurred in shipyards is also emphasized by studies conducted in Japan⁵⁻⁶. In particular, Natori et al.⁶, by examining at necropsy a group of 72 shipyard workers, found asbestos-related conditions in 86% of the cases, including pulmonary asbestosis, pleural plaques, lung cancer, and malignant pleural mesothelioma.

The relationship between malignant mesothelioma and working in shipbuilding is one of the most typical features in mesothelioma epidemiology. A first report dates back to some fifty years ago. In 1953 Weiss⁷ in Germany described a case of pleural cancer co-existing with pulmonary asbestosis. The patient, a 62-year-old man, had worked as an insulator in warship-building from 1920 to 1935; for a further seven years he had worked in the same workplace as a supervisor. Weiss indicated asbestos as the probable cause of this malignancy. In 1958 McCaughey⁸ in Belfast, Northern Ireland, described a series of 13 mesotheliomas of the pleura. In this pathological study, occupational histories were not considered. However, further investigations⁹⁻¹⁰ showed that pleural mesotheliomas in the Belfast area were related to asbestos; in particular, many patients had worked in the shipyards with various trades. In the following decades a number of studies confirmed the relationship of shipbuilding to mesothelioma in Europe¹¹⁻¹², as well as in the USA¹³⁻¹⁴, and Japan⁵⁻

¹⁵. In particular, some shipyard areas have been the object of long-term studies in the UK¹⁶⁻¹⁸, in The Netherlands¹⁹⁻²⁰, in France²¹⁻²², and Italy²³⁻²⁸.

For some decades asbestos exposure has been reduced or has been stopped in the shipyards of various countries. In British Naval dockyards, alternative materials began to replace asbestos from 1963; respiratory protection was introduced in the 1960s¹⁷. In Italy reduction of asbestos use in some shipyards occurred in the mid-1970s. In the Scandinavian countries asbestos use stopped in the early 1980s. However, in the shipyards of many other countries asbestos continues to be used. Amphiboles have been prohibited only recently in Japan and South Korea. In some shipyard areas an early decline in mesothelioma incidence seems to have already occurred¹⁷. However, in other parts of the world shipbuilding workers will continue to be severely affected.

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