Case Report

An Unusual Case Report of Asbestos-Related Visceral Pleural Plaques

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Abstract

Asbestos, a group of minerals known for their fibrous structure and heat-resistant properties, has been widely used in construction and automotive industries. Predominantly derived from chrysotile and amphiboles such as amosite and crocidolite, asbestos is associated with significant health risks due to exposure to airborne fibers, particularly during construction and demolition. Asbestos can cause both malignant and non-malignant chest diseases, including conditions such as pleural effusion, pleural plaques, asbestosis, lung cancer, and malignant mesothelioma. Even though asbestos has been in use in Thailand for over 70 years, only a limited number of asbestos-related disease (ARD) cases have been officially reported. The authors present an unusual case of asbestos-related visceral pleural plaques in a resort owner, likely exposed during the demolition of old houses. Additionally, the present study aims to raise awareness of the ongoing hazards posed by asbestos and to call for stronger asbestos regulation and controls to prevent future ARD cases.

Keywords: asbestos, asbestos-related disease, pleural plaques, visceral pleural plaques, occupational hazards, demolition exposure, surveillance, public health impact

Asbestos refers to a group of minerals identified commercially for their fibrous nature, characterized by crystals that form bundles of fibers easily separated from one another. These minerals originate from metamorphic rocks, which undergo natural recrystallization processes, transforming into fibrous materials. Asbestos minerals fall into two main categories: a) amphiboles, which include amosite (brown asbestos), crocidolite (blue asbestos), anthophyllite, actinolite, and tremolite; and b) serpentines, represented by chrysotile (white asbestos).[1] Chrysotile, the only form of asbestos derived from serpentine minerals, makes up 95% of all asbestos ever used globally and remains the only type still commercially utilized today.[2]

Asbestos exposure can lead to several diseases, such as asbestosis, pleural plaques, pleural thickening, and pleural effusion, which have been widely reported. In addition, it also poses an increased risk of malignant conditions, including malignant mesothelioma and lung cancer. Asbestos is believed to be responsible for nearly half of all occupational cancer deaths globally, making it a persistent public health concern.[3,4] Although Thailand has imported asbestos for more than 70 years with a usage in the year 2020 of 0.5 kg/year/capita, there have been very few reports of asbestos-related disease (ARD) cases.[5,6]

Pleural plaques are the most common manifestation of ARD and are strongly associated with inhalational exposure to asbestos.[7] Pleural plaques typically occur bilaterally on the parietal pleura of the chest wall, diaphragm, or mediastinum. However, visceral pleural plaques are rarely found in asbestos-exposed cases. In the

present study, we report an uncommon presentation of pleural plaques, which involved both parietal and visceral types of pleural plaques. Furthermore, this case study also raises awareness of the adverse health effects of asbestos exposure, underpinning the importance of prevention at all levels.

Case report

An 81-year-old Thai male was referred to Maharat Nakhon Ratchasima Hospital for the management of acute myocardial infarction. After treatment of the acute condition, doctors were concerned about the abnormalities of his chest radiograph. The patient denied histories of blunt chest injury or hemothorax, as well as thoracic infection; however, there was a suspicion of an occupational cause of such abnormalities. As a result, occupational medicine physicians were consulted to further evaluate the patient.

The patient worked as a marble factory owner for 20 years, since 1973. His job involved supervising employees engaged in various tasks, including sawing, hammering, drilling, grinding, and chipping of marble. The working environment was evidently dusty; however, there was no annual workplace environmental monitoring. Additionally, he did not wear any personal protective equipment. Regarding the process, the selection of techniques or equipment depended on the depth of rock excavation and proximity to structures or hazardous areas. A compressed air-based jackhammer was used for smaller rock breaking, while an excavator-mounted hydraulic hammer was used for larger areas. After that, since 2000, the patient has been a resort owner. Importantly, he observed construction workers during the demolition of old houses for three years, from 2000 to 2003. Human operatives carried out demolition at this site, utilizing hand tools and simple electrically or pneumatically powered tools such as picks, hammers, wire cutters, and welding cutters. Nevertheless, the wet technique was not applied during demolition and debris removal.

His chest radiograph reveals abnormalities, as shown in Figure 1. National Institute for Occupational Safety and Health (NIOSH) certified B readers confirmed the chest radiographic abnormalities to be compatible with asbestos-related pleural abnormalities. The abnormalities include calcified face-on and in-profile pleural plaques along both hemithoraces, the left hemidiaphragm, and the bilateral paraspinal regions, according to the International Labour Organization International Classification of Radiographs of Pneumoconioses, revised edition 2022.[8] Two months later, the patient underwent computed tomography (CT) of the chest. The CT in Figures 2 and 3 demonstrates calcifications of both parietal and visceral pleural plaques along both hemithoraces as well as parenchymal bands adjacent to the pleural abnormalities. Interestingly, all fibrosis extends from the visceral pleural surface, indicating visceral-type pleural thickening.[9]

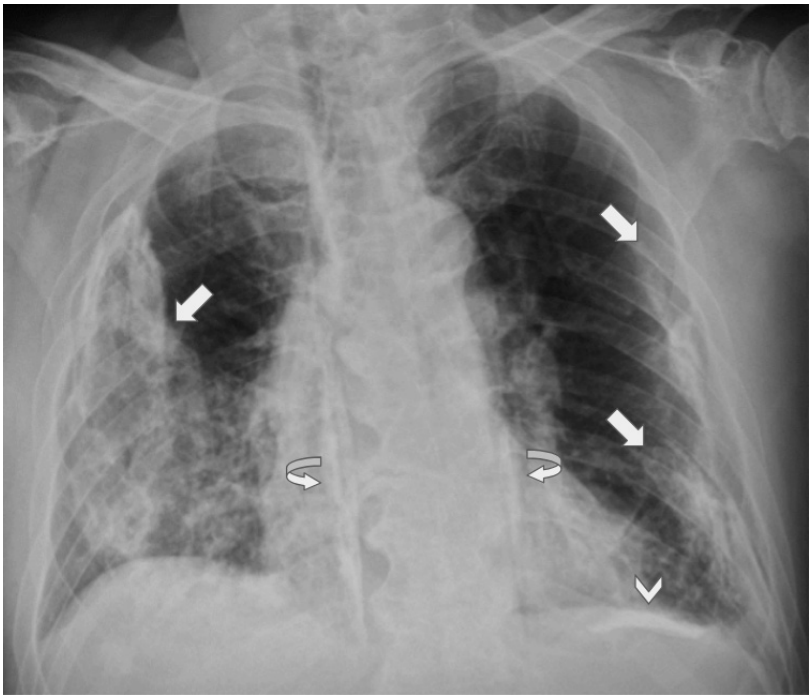

Figure 1: Chest radiograph shows calcified pleural plaques in different areas, including both hemithoraces (white arrows), left hemidiaphragm (arrowheads), and bilateral paraspinal regions (curved arrows).

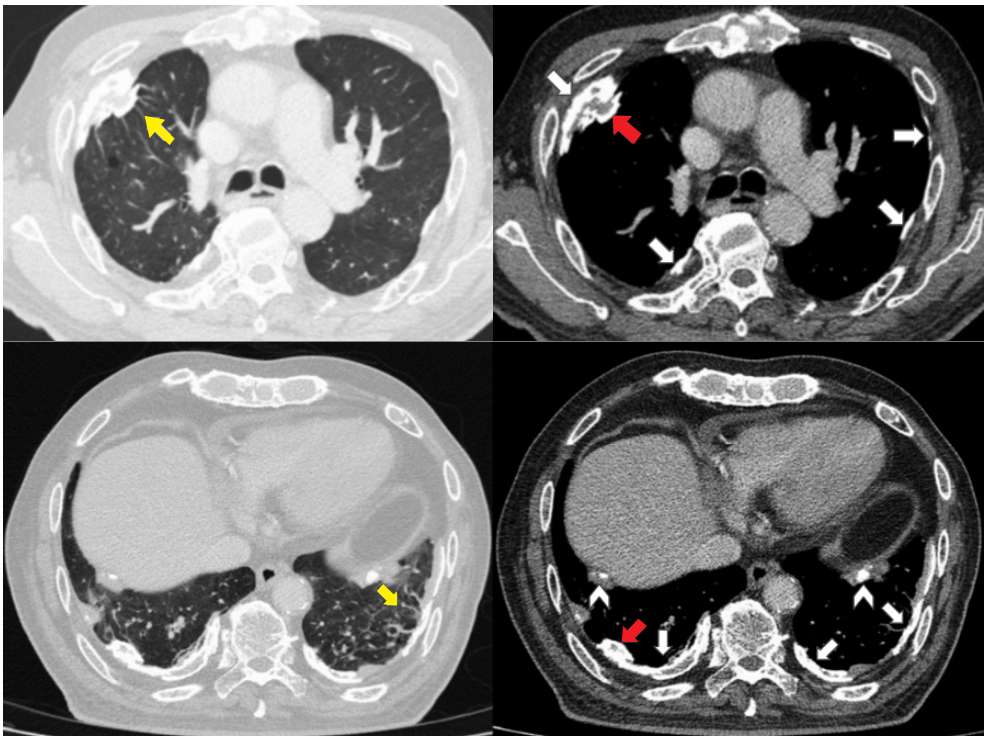

Figure 2: Axial chest CT with contrast images at the different levels in the lung window (left) and mediastinal window (right) show calcified parietal pleural plaques along both hemithoraces (white arrows) and hemidiaphragms (arrowheads). Note the calcification inner to the calcified parietal pleural plaques thought to represent calcified visceral pleural plaques (red arrows). Associated parenchymal bands adjacent to the pleural plaques are depicted in both lungs (yellow arrows).

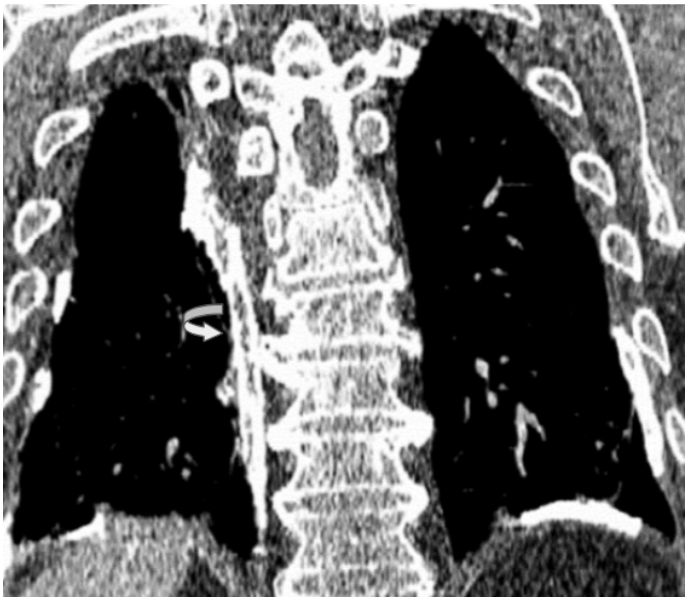

Figure 3: Coronal CT shows calcified right parietal pleural plaque along the mediastinal pleura (curved arrow) corresponding with calcified pleural plaque in the paraspinal region on the radiograph.

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Discussion

In this study, we present a case of asbestos-related pleural plaques affecting both the parietal and visceral pleura. To our knowledge, this is the first case of asbestos-related visceral pleural plaques reported in Thailand. The patient, a resort owner since 2000, was exposed to asbestos while observing construction workers during the demolition of old houses over a period of three years (2000–2003). Demolition activities can disturb asbestos-containing materials, releasing airborne fibers that pose significant health risks. In this case, the patient was likely exposed without using any protective measures.

For many decades, Thailand has ranked among the world's top importers and users of asbestos, following Russia, China, India, and Kazakhstan in yearly consumption.[10] Asbestos exposure occurs especially from reconstruction and destruction of buildings or materials, asbestos contamination, and worn vehicle brakes.[11] Asbestos exposure significantly increases the risk of asbestosis, pleural plaques, pleural thickening, and pleural effusion, which have been widely documented. It is also thought to account for almost half of the global deaths caused by occupational cancer, making it an ongoing public health issue.[3,4]

Pleural plaques are recognized as the hallmark of asbestos exposure and represent the most common manifestation of ARD. In the general U.S. population, they are found in 3% to 58% of workers exposed to asbestos fibers and 5-8% of the general population.[12] Pleural plaques tend to form 20 to 30 years after initial exposure, with calcification occurring later, typically more than 30 years after exposure. While the likelihood of pleural plaques increases with both the duration since first exposure and the total amount of exposure, even low-dose exposures can lead to plaque formation.[13] This timeline also aligns with the patient's exposure history.

Pleural plaques are typically localized pleural thickenings found on the parietal pleura. These hypocellularity lesions consist of dense collagen bundles, with a single layer of normal mesothelial cells covering the pleural surface.[14] Due to their asymptomatic nature, pleural plaques are frequently detected incidentally on imaging. On images, pleural plaques are typically found along lower chest walls (the posterolateral aspect between the seventh and tenth ribs, and the lateral aspect between the sixth and ninth ribs), the dome of the diaphragm (which is almost pathognomonic), and the mediastinal pleura.[15] In this case, the distribution of pleural plaques thereby indicates prior asbestos exposure. Diagnosing asbestos-related pleural plaques relies on compatible radiologic findings, the exposure history, and an appropriate interval between exposure and detection.

ARD can affect the interstitium of the lung and the pleura, manifesting as asbestosis, pleural plaques (associated with the parietal pleura), and diffuse pleural thickening (associated with the visceral pleura), respectively. Despite mostly occurring on the parietal pleura, pleural plaques may also occasionally develop on the visceral pleura.[16] Moreover, visceral pleural involvement can be either focal or diffuse. When focal, they appear as small pleuro-parenchymal fibrous strands, called "crow's feet", now commonly referred to as parenchymal bands.[8,17] When more diffuse, pleural fibrosis is termed "diffuse pleural thickening", typically associated with costophrenic angle obliteration. Interestingly, such visceral-type pleural abnormalities, including visceral pleural plaques, were evident in this patient together with the classic parietal pleural plaques.

Without effective prevention strategies, Thailand is likely to see a growing number of asbestos-related disease (ARD) cases. The best way to prevent ARD is to cease the use of all forms of asbestos, as elimination is the most effective method according to the hierarchy of hazard controls. However, chrysotile asbestos continues to be used in Thailand for some purposes. To mitigate the rising burden of ARD, the country must enforce strict laws and regulations on asbestos use and controls. This effort needs collaboration among all relevant stakeholders, including the Ministry of Public Health. Additionally, other preventive measures, such as substituting asbestos with safer materials and conducting medical surveillance for at-risk individuals, are essential to reducing ARD cases.

In 2019, the Occupational Diseases and Environmental Diseases Control Act B.E. 2562 (2019) under the Ministry of Public Health in Thailand was enacted to legally facilitate the investigation of patients and workplaces potentially affected by occupational and environmental diseases, including ARD.[18] Under this act, employers and healthcare providers are obligated to notify the Department of Disease Control and Provincial Occupational Disease and Environmental Disease Control Committees within 3 days if an employee or individual is suspected of having ARD or within 24 hours if a suspected case results in death. Following the notification, the Occupational Disease and Environmental Disease Control Commission will promptly initiate a thorough investigation, which includes interviews with treating doctors and patients, environmental surveys, and risk assessments in the work area. Ultimately, the primary purpose of the Act is to enable early detection and timely response to such cases.

Conclusions

This case study presents a case of asbestos-related pleural plaques, specifically rarer visceral pleural plaques. It adds to the limited evidence of ARD cases in Thailand. Given the ongoing import and use of asbestos in the country, ARD continues to occur and is expected to become a significant public health problem in the near future. Therefore, immediate action is needed to implement effective preventive and control measures.

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Data availability

The data supporting the findings of this case report are available within the article.

Ethical approval

This study was approved by the Ethics Committee of Maharat Nakhon Ratchasima Hospital (EC number: 67087).

Conflict of interest

The authors declare no conflict of interest.

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References

1. Vicari K, Ribeiro IM, Aguiar BF, et al. Occupational characterization of workers exposed to asbestos: an integrative review. *Rev Bras Med Trab*. 2022;20(4):650-8. doi: 10.47626/1679-4435-2022-733.
2. Collegium Ramazzini. Asbestos is still with us: repeat call for a universal ban. *Int J Occup Med Environ Health*. 2010;23: 201-7. doi: 10.2478/v10001-010-0017-4.
3. McCormack V, Peto J, Byrnes G, et al. Estimating the asbestos-related lung cancer burden from mesothelioma mortality. *Br J Cancer*. 2012;106(3):575–84. doi: 10.1038/bjc.2011.563.
4. Hein MJ, Stayner LT, Lehman E, et al. Follow-up study of chrysotile textile workers: cohort mortality and exposure-response. *Occup Environ Med*. 2007;64(9):616–25. doi: 10.1136/oem.2006.031005.
5. Thai Customs, Imported asbestos statistics. [Internet]. 2024 (Accessed October 16, 2024, at http://www.customs.go.th/statistic_report.php)
6. Buranatrevedh S, Sithisarunkul P, Dumavibhat N, et al. Revision of National Health Assembly Resolution: Thailand's Asbestos Ban Measures. *J Health Syst Resear* 2020; 14(1): 10-18.
7. Roggli VL, Gibbs AR, Attanoos R,et al. Pathology of asbestosis- An update of the diagnostic criteria: Report of the asbestosis committee of the college of american pathologists and pulmonary pathology society. *Arch Pathol Lab Med*. 2010 ;134(3):462–80. doi: 10.5858/134.3.462.
8. ILO International Classification of Radiographs of Pneumoconioses | International Labour Organization [Internet]. 2023 (Accessed October 16, 2024, at https://www.ilo.org/resource/ilo-international-classification-radiographs-pneumoconioses-1).
9. Kusaka Y, Hering KG, Parker JE. International classification of HRCT for occupational and environmental respiratory diseases: pleural diseases: Springer Verlag Tokyo; 2005: 73-92.
10. Le GV, Takahashi K, Karjalainen A, et al. National Use of Asbestos in Relation to Economic Development. *Environ Health Perspect.* 2009;118(1):116-9. doi: 10.1289/ehp.0901196
11. LaDou J. The asbestos cancer epidemic. *Environ Health Perspect*. 2004 ;112(3):285–90. doi: 10.1289/ehp.6704
12. O'Reilly KM, McLaughlin AM, Beckett WS, et al. Asbestos-related lung disease.*Am Fam Physician*. 2007;75(5):683-8
13. Cugell DW, Kamp DW. Asbestos and the pleura: a review. *Chest.* 2004;125(3):1103–17. doi: 10.1378/chest.125.3.1103.
14. Chapman SJ, Cookson WOC, Musk AW, et al. Benign asbestos pleural diseases. *Curr Opin Pulm Med*. 2003; 9(4): 266–71. doi: 10.1097/00063198-200307000-00004.
15. Roach HD, Davies GJ, Attanoos R, et al. Asbestos: when the dust settles-an imaging review of asbestos-related disease. *Radiographics*. 2002; 22(1): 167–84. doi: 10.1148/radiographics.22.suppl_1.g02oc10s167.
16. Tomashefski JF, Cagle PT, Farver CF, et al. Dail and Hammar's pulmonary pathology: Volume I : Nonneoplastic lung disease 3rd edition. Asbestos. Springer Science Business Media. 2008: 950-1032.
17. Gevenois PA, de Maertelaer V, Madani A, et al. Asbestosis, pleural plaques and diffuse pleural thickening: three distinct benign responses to asbestos exposure. *Eur Respir J.* 1998;11(5):1021–7. doi: 10.1183/09031936.98.11051021.
18. Ministry of Public Health. The Occupational Diseases and Environmental Diseases Control Act B.E. 2562 (A.D. 2019) [Internet]. 2019. (Accessed October 16, 2024, at https://ddc.moph.go.th/uploads/files/14120220209073708.pdf)