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A Legacy Written in the Pleura: CT Findings Suggestive of Asbestos Exposure

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Abstract

Pleural plaques are the most frequent radiological manifestation of previous asbestos exposure and may remain clinically silent for decades. Their characteristic morphology and distribution on computed tomography (CT), particularly when calcified, can strongly suggest previous exposure and prompt correlation with occupational history. We report the case of a 78-year-old man who underwent thoraco-abdomino-pelvic CT for staging and assessment of the resectability of a pancreatic head mass. Thoracic CT demonstrated multiple bilateral calcified pleural plaques without associated pulmonary interstitial fibrosis. Review of the patient's occupational history revealed previous military service as a mechanic, representing a potential source of remote occupational asbestos exposure. The combination of a characteristic CT pattern and a compatible occupational history strongly supported asbestos-related pleural plaques. This case illustrates the characteristic CT appearance of pleural plaques and emphasizes their value as a radiological marker of remote asbestos exposure, particularly when the responsible occupational exposure may have occurred decades earlier.

Categories: Occupational Health, Radiology, Pulmonology
Keywords: asbestos, occupational exposure, pleural calcification, pleural plaques, remote asbestos exposure

Introduction

Asbestos refers to a group of naturally occurring fibrous silicate minerals that were historically used extensively because of their durability, tensile strength, and resistance to heat. Inhalation of asbestos fibers is associated with a spectrum of pleuropulmonary abnormalities, ranging from benign pleural manifestations to pulmonary fibrosis (asbestosis) and malignancies such as lung cancer and malignant pleural mesothelioma [1]. Benign asbestos-related pleural disease includes pleural plaques, diffuse pleural thickening, and non-malignant asbestos-related pleural effusion; rounded atelectasis may develop in association with pleural fibrosis [1].

Pleural plaques are the most frequent radiological manifestation of asbestos exposure and represent a highly suggestive marker of previous exposure, although they are not entirely pathognomonic, as similar pleural abnormalities may occur in other conditions [1,2]. Computed tomography (CT) is particularly useful for their detection and characterization, allowing detailed assessment of their morphology, distribution, and calcification, as well as evaluation of the underlying pulmonary parenchyma [3,4].

We present a case of extensive bilateral calcified pleural plaques in an elderly patient with a compatible remote occupational history, highlighting their characteristic CT features and the importance of distinguishing them from other causes of pleural calcification.

Case Presentation

A 78-year-old man underwent contrast-enhanced thoraco-abdomino-pelvic CT for staging and assessment of the resectability of a pancreatic head mass, prior to any oncological treatment. Pleural abnormalities were incidentally identified during evaluation of the thoracic component of the examination and were considered unrelated to the pancreatic mass.

CT demonstrated multiple bilateral, multifocal pleural plaques, many of which were densely calcified, involving the costal pleural surfaces and both hemidiaphragms (Figure *1*). The apical pleura and costophrenic angles were spared. The plaques were well-defined and discontinuous, without associated diffuse pleural thickening, dissociating them from the more extensive, continuous pleural involvement characteristic of diffuse asbestos-related pleural thickening. No pleural effusion or suspicious pleural mass was identified. Evaluation of the lung parenchyma on lung-window images showed no reticular abnormalities, architectural distortion, or other interstitial fibrotic changes. There was no CT evidence of pulmonary asbestosis (Figure *2*).

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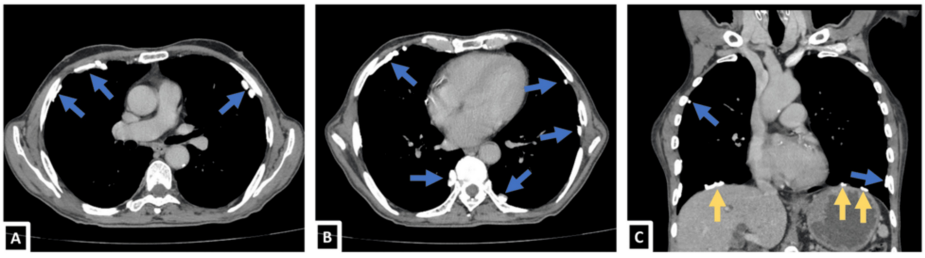


FIGURE 1: Bilateral calcified pleural plaques

Axial (A, B) and coronal (C) contrast-enhanced computed tomography (CT) images displayed in mediastinal windows demonstrate multiple bilateral calcified pleural plaques involving the costal and diaphragmatic pleural surfaces. Blue arrows indicate costal pleural plaques, while yellow arrows indicate diaphragmatic pleural plaques.

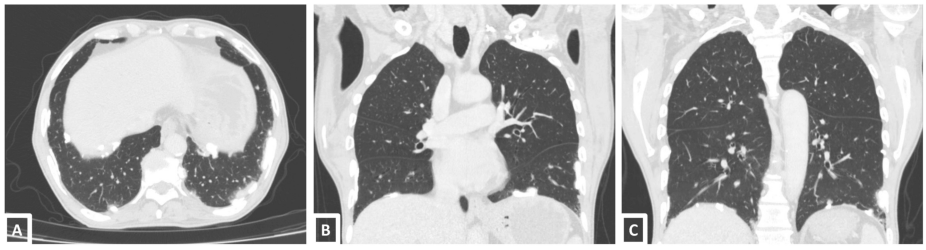


FIGURE 2: Pulmonary parenchymal findings

Axial (A) and coronal (B, C) computed tomography (CT) images displayed in a lung window demonstrate no interstitial fibrotic abnormalities to suggest concomitant pulmonary asbestosis.

The characteristic appearance and distribution of the pleural abnormalities prompted further investigation of the patient's occupational and medical history. He had completed vocational training in mechanics and subsequently worked as a military mechanic for 32 years, performing maintenance and repair work involving brake linings and clutches. His mechanical duties ended approximately 25 years before the CT examination, after which he continued serving in the military in other roles until retirement. Although these activities may have involved contact with asbestos-containing materials, direct exposure could not be confirmed. He was a former smoker with a 15-year smoking history of approximately one pack per week (2.1 pack-years), having quit more than 20 years before the examination. There was no known history of tuberculosis, previous pleural infection, hemothorax, thoracic surgery, pleurodesis, or other pleural disease.

Considering the bilateral multifocal calcified pleural plaques and the patient's prolonged occupational history as a mechanic, the imaging findings were considered highly suggestive of asbestos-related pleural plaques, although this attribution remains presumptive in the absence of documented direct asbestos exposure. No pleural biopsy was performed, as the CT findings were characteristic of benign pleural plaques, without suspicious features warranting histological investigation.

Discussion

Asbestos exposure is associated with several benign pleural manifestations, including pleural plaques, diffuse pleural thickening, and non-malignant asbestos pleural effusion; rounded atelectasis may occur as a secondary parenchymal consequence of pleural disease [1]. Histologically, pleural plaques consist of localized areas of hyaline fibrosis involving the parietal pleura [1]. They are generally asymptomatic and constitute an important marker of previous asbestos exposure [1].

The CT appearance of pleural plaques is well established. They typically manifest as bilateral, multifocal, flat or nodular areas of pleural thickening, with a characteristic distribution along the posterolateral and anterolateral chest wall and diaphragmatic pleura [3]. Pleural plaques may undergo partial or complete calcification, which can make them particularly conspicuous on CT [3]. The bilateral calcified plaques involving the costal and diaphragmatic pleural surfaces in our patient, with sparing of the apices and the costophrenic angles, were consistent with this characteristic imaging pattern.

CT plays a central role in the evaluation of occupational lung disease, allowing assessment of both pleural and pulmonary parenchymal abnormalities [4]. Accurate identification of pleural plaques relies on recognition of their characteristic appearance and distribution together with correlation with the patient's

occupational history [5]. In our patient, no associated interstitial pulmonary fibrosis was identified, indicating pleural involvement without CT evidence of concomitant pulmonary asbestosis. Evaluation of the lung parenchyma remains an important component of the CT assessment of asbestos-exposed individuals [4].

One of the most relevant features of asbestos-related pleural disease is its prolonged latency. Pleural plaques may become radiologically apparent several decades after exposure, meaning that the occupational event responsible for the imaging findings may be remote and not initially volunteered by the patient [1]. Menant et al. evaluated 5,392 asbestos-exposed workers and demonstrated significant relationships between pleural plaque occurrence, cumulative asbestos exposure, and time since first exposure [6]. These observations reinforce the value of a detailed lifetime occupational history when a characteristic pleural pattern is encountered.

The occupational history in our patient was notable for 32 years of military service as a mechanic, including maintenance and repair work involving brake linings and clutch components. Such activities have historically represented a potential route of asbestos exposure because asbestos-containing materials were incorporated into friction products [7]. Ameille et al. evaluated 103 automobile mechanics without another identified source of occupational asbestos exposure and detected pleural plaques on high-resolution CT in five individuals (4.9%), whereas interstitial abnormalities compatible with asbestosis were identified in only one [7]. The occurrence of pleural plaques was associated with longer duration of occupational exposure [7]. However, the exposure profile of civilian automobile mechanics may not fully reflect that of military mechanics.

Nevertheless, employment as a mechanic does not by itself establish definite asbestos exposure. The likelihood and intensity of exposure depend on the period of employment, specific tasks performed, materials handled, working environment, and use of protective measures. In our patient, although the duration and nature of his mechanical duties could be established, details regarding the working environment, protective measures, and asbestos content of the materials handled remained unavailable. The Helsinki Criteria emphasize the importance of a comprehensive occupational and environmental history when assessing asbestos-related disease [8]. Accordingly, our patient's military mechanical work should be regarded as a plausible source of remote asbestos exposure rather than definitive evidence of exposure.

The differential diagnosis of pleural calcification includes sequelae of previous pleural infection or inflammation, hemothorax, and pleurodesis [1,3]. Morphology and distribution are useful in narrowing this differential [3]. Asbestos-related pleural plaques typically show a multifocal, often bilateral distribution with characteristic involvement of the parietal and diaphragmatic pleura [1,3]. CT also allows assessment for features that would raise concern for an alternative pleural process, including diffuse or nodular pleural thickening, pleural effusion, or other findings suspicious for malignancy [9]. No such suspicious pleural features were present in our patient.

Pleural plaques are benign lesions, but their identification has clinical significance because they represent radiological findings supportive of previous asbestos exposure [1]. Although some studies have reported an association between pleural plaques and lung cancer incidence or mortality, others have found no additional risk after adjustment for asbestos exposure and smoking. Thus, their independent predictive value for lung cancer remains uncertain [10-12].

The characteristic CT morphology and distribution of the pleural plaques, together with the compatible occupational history and absence of suspicious pleural features, supported a benign pleural process highly suggestive of asbestos-related pleural disease. However, attribution to asbestos exposure remained presumptive in the absence of documented direct exposure.

This case demonstrates how a characteristic pleural pattern on CT can provide evidence of remote occupational exposure decades after the presumed exposure period. Recognition of the typical morphology and distribution of calcified pleural plaques, combined with a careful occupational history, remains central to their interpretation.

Conclusions

Pleural plaques are a characteristic radiological marker of previous asbestos exposure and may become apparent decades after the responsible occupational exposure. CT typically demonstrates bilateral, multifocal pleural thickening involving characteristic parietal and diaphragmatic locations, with calcification frequently present.

Recognition of this imaging pattern should prompt careful review of the patient's lifetime occupational history, particularly in older individuals whose exposure may have occurred many years previously. Pleural plaques can be confidently identified based on their characteristic CT appearance, whereas attribution to asbestos exposure requires consideration of the occupational history and alternative etiologies. Simultaneous assessment of the pulmonary parenchyma and evaluation for atypical or suspicious pleural

features complete the imaging evaluation.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

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