Bilateral Mobile Thoracolithiasis

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ABSTRACT

Thoracolithiasis is the presence of one or more freely mobile pleural stones (with or without calcification) in the pleural space. They occur with a reported incidence of less than 0.1% and are benign and do not require intervention. Historically, they have led to unnecessary interventions - something unlikely in the era of multidetector computed tomography (CT). Thoracolithiasis should be included in the differential diagnosis of a single or multiple, mobile peripheral pulmonary nodules. Here, we review the imaging characteristics of a rare case of bilateral mobile thoracolithiasis.

CASE REPORT

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A 70-year-old female with hypogammaglobulinemia, hypothyroidism, previous cholecystectomy, and a history of left subclavian vein thrombosis presented to the emergency department with unresolving cough, flu-like symptoms and pleuritic chest pain. Chest X-ray (CXR) demonstrated patchy right lung consolidation which was reported as likely bronchopneumonia. In view of the pleuritic chest pain and history of venous thrombosis, CT thorax was requested to rule out pulmonary embolism. This demonstrated bilateral bronchopneumonia, with an additional incidental finding of a 2.4 cm subpleural calcific lesion with central low density in the dependent portion of the right mid-to-lower lung zone (Figure 1A). The calcification was initially thought to represent a subpleural granuloma; however, comparison with a previous abdominal CT for an unrelated indication revealed that the calcification was in a different location (Figure 1C). An additional 5mm left-sided subpleural calcific density was also noted, abutting the left cardiac margin (Figure 1B). This small left-sided stone had also changed in position in the interval (Figure 1D). The larger right-sided stone was also visible on previous abdominal and chest radiographs (Figure 2).

The patient was admitted to medicine and clinically improved after a course of antibiotics. A follow-up CT thorax was performed 2 months later, which confirmed resolution of bilateral bronchopneumonia. There was interval change in position of both pleural calcifications (Figure 1E, F).

DISCUSSION

Etiology and Demographics

Thoracolithiasis is defined as a freely mobile nodule in the pleural cavity with or without calcification [1]. It was first described in 1968 by Dias et al [2]. Other names used to describe this condition include 'pleural stone', 'intrathoracic calculus', and 'pleurolith' [3]. Thoracolithiasis is rare. In 2010, Kinoshita et al. estimated a prevalence of 0.086% after reviewing 12,835 individuals who received at least two CT scans [1]. There is no known age or sex predilection [3]. The stones tend to occur on the left more frequently than the right, with approximately 75% being left sided [1-6].

Histologically, pleural stones often have an outer fibrous layer with a fatty core with or without central necrosis. Although the etiology is unknown, one prevalent theory suggests that stones originate from necrosis of the pericardial fat. This aligns with both the most common histology and the finding that stones are more commonly found on the left, where is there more pericardium [1]. Histological heterogeneity suggests that more than one etiology can result in pleural stone formation. Other theories suggest that pleural stones may originate from a pleural lipoma tearing off, a focus of old pulmonary tuberculosis, or an aggregation of macrophages phagocytosing dust [3].

It is not clear in the literature whether or not lung pathology predisposes patients to developing pleural stones. Our patient had bronchopneumonia and bilateral stones; however, the temporal relationship between the onset of the stones and any other prior lung pathology is unknown.

Clinical and Imaging Findings

Thoracolithiasis is a benign entity that does not require removal, although historically it had provoked unnecessary intervention [6-8]. Radiologic findings are important in order to differentiate this entity from potentially harmful lesions. Larger pleural stones can be seen on plain radiographs, but CT scan plays the most central role in diagnosis [3]. In particular CT helps confirm calcific density when the density of the nodule is indeterminate on CXR. The size of the stones ranges from 5 to 15mm [1] and occur more frequently in the left pleural cavity. The stones are usually ovoid and smoothly marginated. Since they are mobile, location varies on serial imaging[11]. They are most often found in the dependent part of the pleural cavity on the surface of the diaphragm, on the chest wall adjacent to the lower lung, abutting the left cardiac margin, or near the paraspinal space [1]. Although lesions may or may not be calcified, most contain variable patterns of calcification including spotty and central, peripheral "eggshell", and diffuse and homogeneous [4,5,9]. Since they often contain central fat, pleural stones may have central low density, like the larger right-sided stone in our patient [3]. In one reported case, Magnetic Resonance Imaging (MRI) demonstrated high central T1 and T2 signal, indicating fat [5].

Differential Diagnosis

Thoracolithiasis is rare differential diagnosis for incidental single or multiple calcified subpleural pulmonary nodules. The main differential diagnosis is granuloma, usually in response to healed infection. Broad differential considerations of a calcified lesion include hamartoma, and metastases from medullary thyroid carcinoma, breast fibrosarcoma, extrathoracic primary mucinous neoplasm or osteosarcoma [10]. However, demonstration of mobility on serial imaging confirms thoracolithiasis.

Treatment and prognosis

Thoracolithiasis is benign. However, it is important to review radiologic findings in order to definitively differentiate these nodules from other lesions.

TEACHING POINT

Thoracolithiasis is a rare benign pulmonary entity that should be differentiated from other potentially harmful lung pathology based on characteristic radiologic findings, including extrapleural location and demonstration of mobility on serial imaging.

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FIGURES

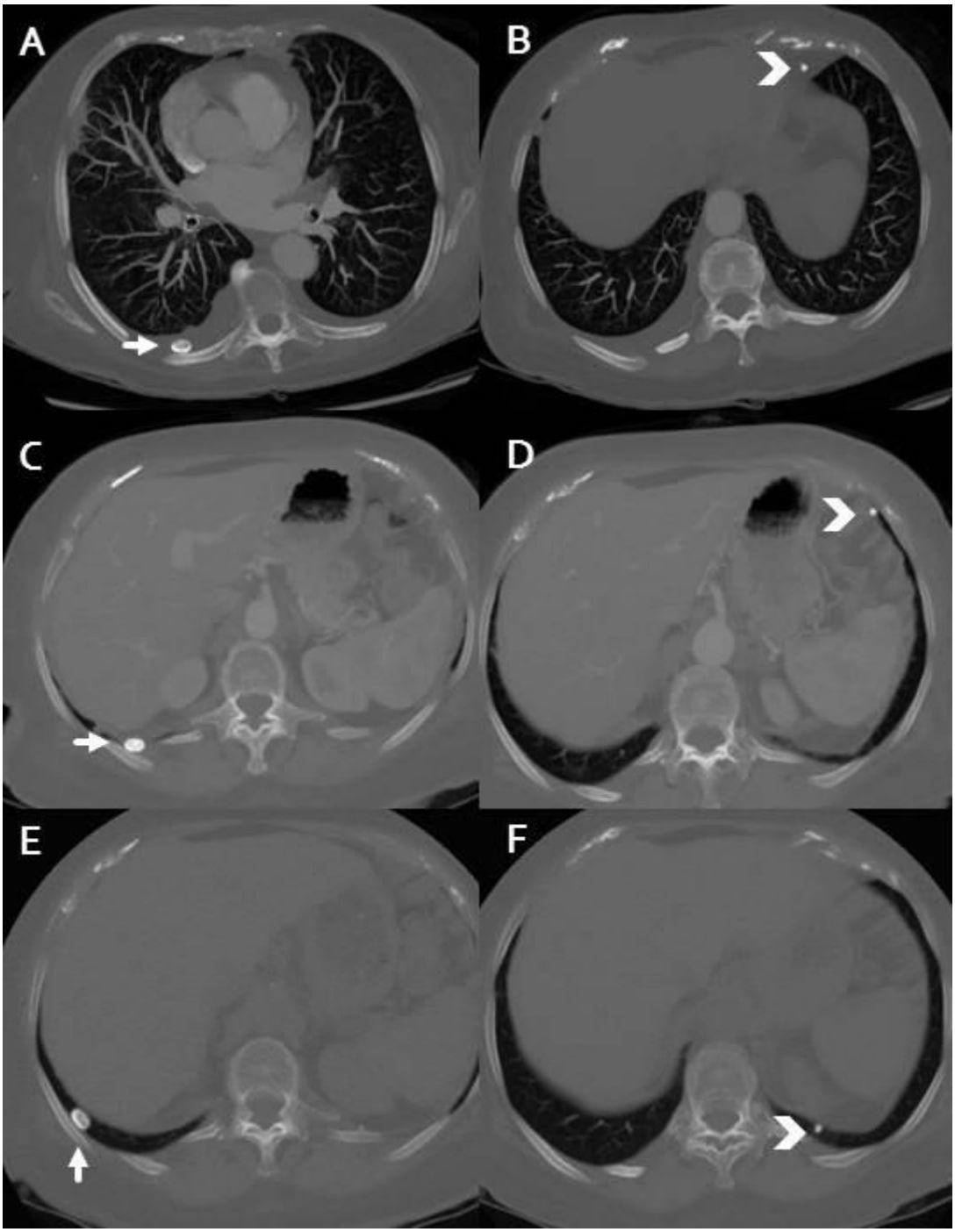

Figure 1: Bilateral mobile thoracolithiasis in a 70-year-old female. Axial CT images show a large right pleural stone (white arrow) and a small left pleural stone (white arrowhead), both of which shifted in position between presentation (A, B), 6-month prior (C, D) and 2-month follow-up (E, F). The larger stone on the right changed positions between the mid-posterior pleural space (A) to lower-posterior pleural space (C, E). The smaller stone on the left moved from the anterior pleural space (B, D) to the posterior pleural space (F).

All CT images were acquired on a 64-slice GE LightSpeed VCT scanner. Images A-B were acquired using our routine CT pulmonary angiogram protocol (contrast enhanced acquisition at peak pulmonary opacification with 1.25mm overlapping collimation utilizing 60ml of iodixanol 320 contrast at 120kV with tube current modulation and adaptive statistical iterative reconstruction); images C-D using our routine CT abdomen with contrast protocol (contrast enhanced acquisition at portal venous phase with 3mm overlapping collimation utilizing 80ml of iodixanol 240 contrast at 120kV with tube current modulation and adaptive statistical iterative reconstruction); and images E-F using our routine CT thorax without contrast protocol (contrast enhanced acquisition at arterial phase with 2.5mm overlapping collimation utilizing 60ml of iodixanol 240 contrast at 120kV with tube current modulation and adaptive statistical iterative reconstruction).

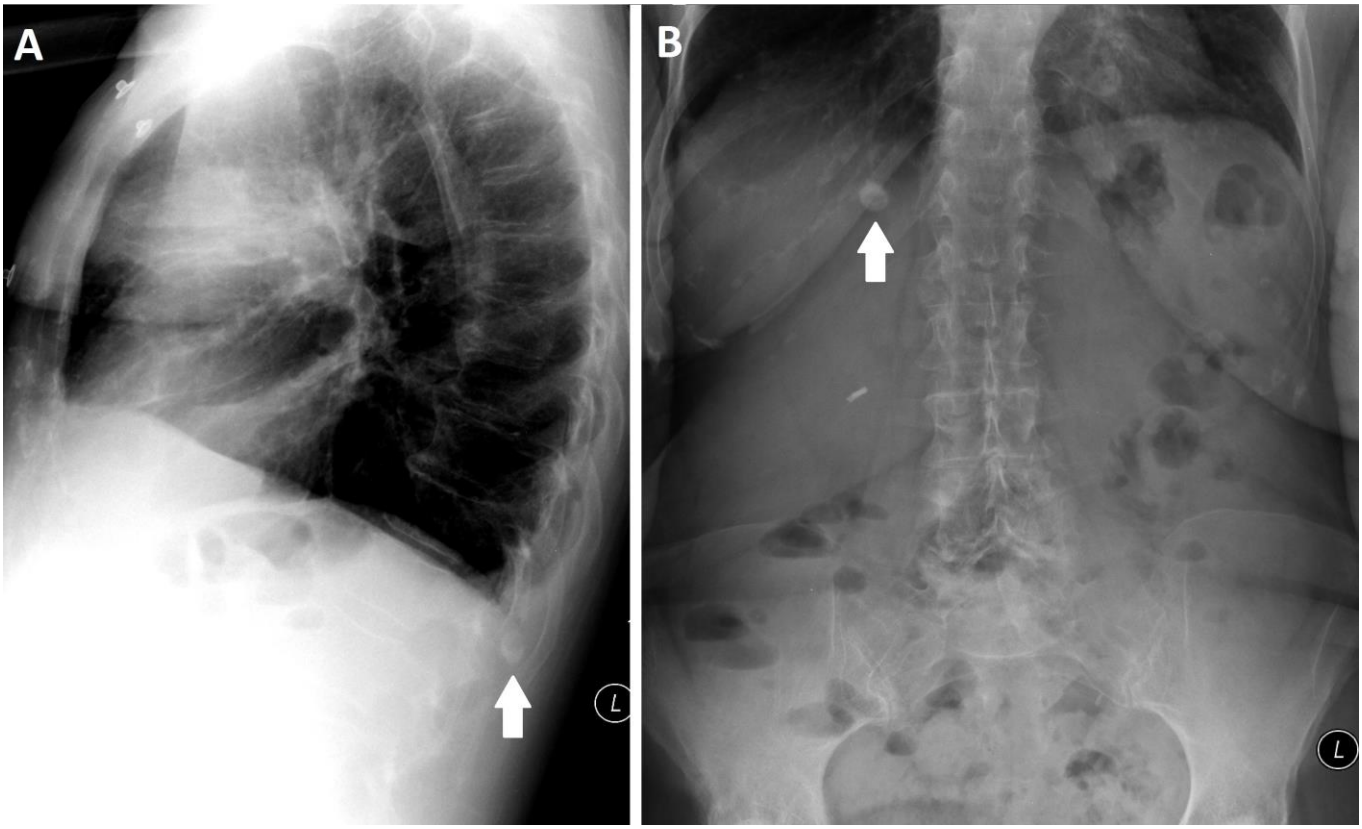

Figure 2: Thoracolithiasis in a 70-year-old female. Plain radiographs of the chest (A) and abdomen (B) show a round calcific density located in the right posterior costophrenic angle (white arrows).

Etiology	Stone formation is theorized to originate from necrosis of the pericardial fat, which may be related to the finding that the stones are more commonly found on the left, where is there more pericardium.
Incidence	Thoracolithiasis is rare, with an estimated prevalence of 0.086%.
Gender Ratio	There is no known sex predilection.
Age predilection	There is no known age predilection.
Risk Factors	It is not clear whether lung pathology predisposes patients to developing pleural stones.
Treatment	Thoracolithiasis is benign and does not require intervention.
Prognosis	Thoracolithiasis is benign.
Findings on imaging	- Range in size from 5 to 15mm in diameter - Intrapleural in location, occurring more frequently in the left pleural cavity - Usually ovoid and smoothly marginated - Since they are mobile, location varies on serial imaging - May or may not be calcified. Those that are calcified contain variable patterns of calcification including spotty and central, peripheral "eggshell", and diffuse and homogeneous. - Since they often contain central fat, pleural stones may have central low density.

Table 1: Summary table of thoracolithiasis

Differential Diagnosis	CT Findings	MRI Findings
Thoracolithiasis	• Intrapleural extraparenchymal lesion ± calcification. • Usually ovoid, smoothly marginated. Size ranges from 5 to 15mm. • Demonstration of mobility on serial imaging confirms diagnosis.	• One reported case demonstrated high central T1 and T2 signal indicating fat. Intrapleural lesion ± calcification. • Size and mobility features similar to CT.
Calcified Granuloma	• Intraparenchymal calcified lesion • Pattern of calcification usually central, laminated or diffuse solid.	• Usually not visualized on MRI
Hamartoma	• Intraparenchymal lesion with popcorn calcifications or intra-nodular fat.	• T1 – intermediate signal with internal foci of hyperintensity (fat) and regions of hypointensity (fibrous or calcific component). • T2 – variable signal depending on content of fat (hyperintense), calcium (hypointense). • T1 with gadolinium – heterogeneous enhancement.
Metastatic Disease	• Multiple well-circumscribed round intraparenchymal lesions of variable size, with soft tissue attenuation. • More often in the lung periphery.	• Not routinely used. • May show low or intermediate signal intensity on T1, slightly higher on T2. • MRI less sensitive than CT in characterizing pulmonary metastasis.

Table 2: Differential diagnosis table for thoracolithiasis

ABBREVIATIONS

CT = Computed Tomography
CXR = Chest X-ray
MRI = Magnetic Resonance Imaging

KEYWORDS

Thoracolithiasis; pleural stone; pleural calcification; thoracic disease; bilateral