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What is This?
A Patient With Trauma Having Cavitary Pulmonary Nodules: Should Further Workup be Pursued?

Dharmi Patel, MD1 and Nader Kamangar, MD, FACP, FCCP, FCCM1

Abstract

Background: Traumatic pulmonary pseudocysts (TPPs) are rare sequelae of blunt chest trauma and may be incidentally visualized on initial, or subsequent, chest imaging. Case: We present the case of a 37-year-old male with no past medical history, who was recently hospitalized in the intensive care unit after a motor vehicle accident and referred to our institution for a traumatic cataract repair. His preoperative chest radiograph revealed multiple left-sided pulmonary nodules that were confirmed on thoracic computed tomography (CT) and noted to be cavitary. Comparison of the films to prior imaging, negative infectious workup, and absence of any symptoms led to the diagnosis of TPPs. Follow-up imaging showed complete resolution of the lesions. Conclusion: The TPPs may be discovered on imaging shortly after blunt chest trauma and, in asymptomatic individuals, can often be monitored with observation and serial imaging.

Keywords

pseudocyst, pulmonary, cavitary, blunt trauma

Introduction

Traumatic pulmonary pseudocysts (TPPs) are rare sequelae of blunt chest trauma encountered in <5% of the cases.1 Interestingly, they may not be present on initial plain chest radiograph but are often visible on thoracic computed tomography (CT). Pathophysiology involves the laceration of alveoli during rapid recoil of the chest wall after compression during blunt chest trauma.2 Unless complications such as bleeding or secondary infection arise, observation alone is sufficient. The majority of these pseudocysts resolve spontaneously within months and can be monitored with serial imaging. Awareness of the natural progression of these lesions is important to avoid unnecessary tests and procedures.

Case Description

A 37-year-old healthy male was involved in a motor vehicle accident, from which he sustained left rib fractures and a hemothorax requiring chest tube placement and admission to the intensive care unit at an outside hospital. After 3 weeks, he was discharged with follow-up at our institution for a traumatic cataract repair. As part of the preoperative workup, a chest radiograph was obtained, which revealed multiple well-circumscribed, left-sided pulmonary nodules (Figure 1). Based on this finding, the patient was asked to return to the hospital for further evaluation. At the time of presentation, he denied any significant symptoms, including dyspnea, cough, hemoptyis, fevers, or night sweats. He did not have a history of smoking, drug use, or incarceration. He lived in a small city near Los Angeles and had not traveled outside the area recently. Due to the imaging findings, there was an initial concern for a potential infectious etiology, specifically pulmonary tuberculosis; therefore, the patient was admitted to the medicine service for expedited workup of his pulmonary nodules.

Initial physical examination was remarkable for a temperature of 36.8°C, blood pressure 125/56, heart rate 77 beats per minute, respiratory rate of 17, and oxygen saturation of 100% on room air. He was slim and had some abrasions over his left forehead as well as ecchymosis around the left eye. His lungs were clear to auscultation bilaterally, and he did not appear to be in respiratory distress. Testicular examination was within normal limits. Laboratory studies revealed a normal complete blood count and basic metabolic panel. His alphafetoprotein level was within normal limits at

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1.9 ng/dL. Coccidioidomycosis serologies, quantiferon gold, and rapid human immunodeficiency virus (HIV) tests were negative. Contrast-enhanced thoracic CT was notable for numerous rib fracture deformities of the posterior left fourth through eighth rib and at least 7 left-sided, fluid-filled pulmonary cavities, the largest measuring 2.6 × 3.7 × 4.3 cm (Figures 1 and 2).

Throughout his short hospitalization, the patient remained asymptomatic. Initial etiologic considerations included atypical infections such as coccidioimycosis and mycobacteria, malignancy, and thoracic splenosis. These differential diagnoses were excluded based on the laboratory data. Records from the patient’s recent outside hospitalization were obtained and compared to his most recent images. Findings on thoracic CT immediately after the motor vehicle accident were consistent with early manifestations of pulmonary pseudocysts with associated surrounding pulmonary contusions. Given the likely diagnosis of TPPs in an asymptomatic individual with a negative infectious workup, no further invasive tests were performed and the patient was discharged home with outpatient follow-up.

Repeat thoracic CT performed 1 month later showed a notable decrease in the size of the left-sided pulmonary pseudocysts, with the largest measuring 3.0 × 2.2 cm and more homogeneous in appearance (Figure 2). The patient remained asymptomatic, and repeat imaging 6 months later showed complete resolution of the lesions.

Discussion

Evaluation of a patient after blunt chest trauma involves a thorough physical examination and imaging. An unusual finding that is sometimes discovered on plain radiograph or CT is the early manifestation of TPPs. The TPP is a rare manifestation of blunt thoracic trauma with a reported incidence of 0.34% in all thoracic traumas. Originally described by Fallon in 1940, it refers to the development of air-filled or fluid-filled cavity without a true epithelial lining within the lung parenchyma, usually after a high-speed motor vehicle accident or fall. Although generally uncommon, cases of TPPs have been reported in infants, children, and adults, but the majority seem to occur in those less than 30 years of age with a male predominance. The proposed mechanism is similar despite differences in body size but manifestations tend to be most pronounced in younger individuals due to the compliance of their chest walls.3 Symptoms may include cough, dyspnea, hemoptysis, and chest pain, although they are often related to associated thoracic injuries and not TPPs themselves.

The pathogenesis of TPPs is related to the shear forces often experienced during a motor vehicle accident. Compression of the chest wall, followed by rapid elastic recoil, results in laceration of alveoli and bronchioles, with subsequent air filling and formation of confluent pulmonary cavities. These cavities may fill with hemorrhagic material from surrounding alveolar capillaries or pulmonary vessels.2 Due to the absence of a true epithelium, these structures are more commonly referred to as pseudocysts. It is important to note that TPPs are primary lesions and not secondary to, for example, a hematoma.4 A mechanism proposed by Wagner and colleagues suggests that these pseudocysts form more commonly in the lower lobes due to compression of the more compliant lower chest wall against the vertebral bodies.5 However, in a series of 33 patients with TPPs, the left upper lobe was found to be the most common site (34% of cases), suggesting that any lobe can be affected.6

Traumatic pulmonary pseudocysts are often missed on initial chest radiography and may require thoracic CT for detection. In all, 100% of the TPPs were noted to be undetectable on chest radiograph in a retrospective review of 10 patients.2
One of the reasons for this may be that the pseudocysts are still in its early stages of formation and therefore not yet detectable on plain imaging. Thoracic CT also allows for the advantage of distinguishing specific characteristics of the TPPs, such as fluid-filled versus air-filled cavities. Generally on CT, TPPs appear as thin-walled cavities within the lung parenchyma that are filled with air or both air and fluid. They tend to be oval shaped with well-defined borders. Sizes have been reported to be anywhere from 2 to 10 cm in diameter. Although TPPs are rare entities, the high sensitivity of CT scans for these lesions and the increasing use of CT scans in patients with trauma may increase the frequency of detection. The incidence of TPPs was noted to be 9.8% in a retrospective review of 33 patients, compared to the documented incidence of 3%, likely because all of the 33 patients with suspected lung injury had undergone CT scan during some point in their hospitalization.

The treatment for uncomplicated TPPs consists of close observation and serial imaging to ensure resolution. The TPPs have been documented to show significant interval decrease in size in as little as 20 hours after the initial post-trauma CT scan. In a series of 12 cases of TPPs analyzed by Chon and colleagues, the mean time for complete resolution of the pseudocysts differed for patients with uncomplicated TPPs (25.3 days) and complicated TPPs (145.8 days), which were defined as “blood-filled” cysts. The overall mean time for complete resolution was approximately 85 days. Although the resolution time differed, outcomes were similar, and conservative treatment with close follow-up was noted to be the standard of care for this condition. These findings are similar to another series of 12 cases described by Kato and colleagues in which all TPPs resolved without treatment within 1 to 4 months (average of 1.8 months). Most recently, Luo and colleagues also found that “air-filled cavities” resolved faster than “air-fluid cavities” (16.3 days with the former vs 47.5 days with the latter), likely due to the presence of vascular injuries in addition to alveolar injuries with air-fluid cavities. The study also noted that no patients died as a result of TPPs. The treatment for uncomplicated TPPs consists of close observation and serial imaging to ensure resolution. The TPPs have been documented to show significant interval decrease in size in as little as 20 hours after the initial post-trauma CT scan. In a series of 12 cases of TPPs analyzed by Chon and colleagues, the mean time for complete resolution of the pseudocysts differed for patients with uncomplicated TPPs (25.3 days) and complicated TPPs (145.8 days), which were defined as “blood-filled” cysts. The overall mean time for complete resolution was approximately 85 days. Although the resolution time differed, outcomes were similar, and conservative treatment with close follow-up was noted to be the standard of care for this condition. These findings are similar to another series of 12 cases described by Kato and colleagues in which all TPPs resolved without treatment within 1 to 4 months (average of 1.8 months). Most recently, Luo and colleagues also found that “air-filled cavities” resolved faster than “air-fluid cavities” (16.3 days with the former vs 47.5 days with the latter), likely due to the presence of vascular injuries in addition to alveolar injuries with air-fluid cavities. The study also noted that no patients died as a result of TPPs.

![Figure 2](image-url)
When complications arise, such as bleeding, infection, or rupture into the pleural space leading to pneumothorax, invasive therapy may be necessary to prevent significant morbidity and mortality. This may include CT-guided drainage of secondary infections, which more commonly occurs in those that are larger in size (>2 cm), particularly if they fail to respond to systemic antibiotics or interventions as aggressive as an emergency lobectomy for massive endobronchial bleeding or infected TPPs that fail to resolve with percutaneous drainage. Transbronchial biopsy of a traumatic pulmonary pseudocyst may show hemorrhage. Although pneumothorax secondary to rupture of the TPP into the pleural space has been reported, most are related to the other reasons associated with thoracic trauma and not the TPP itself. In patients on mechanical ventilation, positive pressure ventilation can lead to enlargement of TPPs. This can ultimately impair ventilation, leading to worsening hypoxemia and respiratory deterioration. Chest tube thoracostomy, video-assisted thoracoscopic surgery, or open thoracotomy is often indicated for such patients.

In conclusion, TPPs represent one of the very rare complications of blunt thoracic trauma generally seen in younger adults. Patients are typically asymptomatic or may present with cough, chest pain, hemoptysis, and dyspnea. Thoracic CT often shows well-defined, air-fluid and/or fluid-filled cavity surrounded by pulmonary contusion, more commonly affecting the lower lobes. The TPPs generally follow a benign course and can be followed with close observation and serial imaging unless other thoracic injuries are also present or complications arise. The average time for radiographic resolution of these pseudocysts can be anywhere from less than a month, if uncomplicated, or up to 5 months, if fluid filled. It is important for clinicians to be aware of the clinical significance and radiographic features of traumatic pseudocysts in order to avoid unnecessary diagnostic tests and interventions.

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