

Traumatic Pulmonary Pseudocysts: A Challenging Diagnosis

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Abstract

Traumatic pulmonary pseudocysts are a rare complication of chest trauma, with most cases occurring before the age of 30, due to the greater elasticity of the chest wall. They can be identified on a chest radiography, but computed tomography is more sensitive in early detection and differential diagnosis. We present the case of a 14-year-old adolescent who was admitted for chest trauma after being run over by a car. Identification of cystic lesions in the chest computed tomography prompted an investigation of a possible infectious and thromboembolic etiology but was negative. The diagnosis of traumatic pulmonary pseudocysts was established, with the complete resolution of the lesions after three months. Although they are rare, traumatic pulmonary pseudocysts should be considered in cases of chest trauma in order to avoid unnecessary diagnostic and therapeutic procedures. In the absence of complications, treatment is conservative and the prognosis is good.

Keywords: Traffic Accidents, Traffic; Adolescent; Pseudocyst/etiology; Contusions/complications; Differential diagnosis, Differential; Lung Diseases/diagnostic imaging; Computed Tomography

Introduction

Traumatic pulmonary pseudocysts are an uncommon complication of blunt thoracic trauma, occurring in 0.34% of all thoracic trauma¹⁻³ and particularly in 3.9% of pediatric blunt thoracic trauma.⁴ Their presence may be underdiagnosed at the pediatric age, since thoracic trauma is mostly associated with low-energy mechanisms in this age group and chest imaging is not usually performed. Indeed, in a study by Armstrong *et al.* on 204 children and adolescents with pulmonary contusion diagnosed by imaging, traumatic pulmonary

pseudocysts were identified in 12.3% of the cases.⁵ Traumatic pulmonary pseudocysts are cavities without true epithelial lining,^{1,4} filled with air, fluid, or blood. They may be single or multiple, with single or multiple loculations and are elliptical or spherical in shape.^{4,6} They can occur in any area of the lung, but apexes are usually unaffected.^{4,7,8}

Traumatic pulmonary pseudocysts are the result of a violent thoracic impact,⁴ with compressive and shear force transmitted to the pulmonary parenchyma. Before the age of 30, the chest wall is more compliant and, therefore, any force applied to the chest is more easily transferred to the lung parenchyma.⁷ The formation of pseudocysts is the result of pulmonary elastic retraction and the transfer of air from the airway to the injured area, with air becoming trapped in the cavities formed.² They increase progressively in size until a pressure balance is reached between the cavities and the surrounding lung tissue.^{1,4,8,9} Traumatic pulmonary pseudocysts may be associated with rib fracture (20% cases), pneumothorax, or pneumomediastinum.^{4,6} Other injury mechanisms are penetrating lesions, barotrauma^{1,2,8}, or invasive ventilation.^{4,8}

Chest radiography may present false negatives in the diagnosis of traumatic pulmonary pseudocysts. Identification of the round or oval image, usually surrounded by bruised lung tissue and possibly with air-fluid level (intracavitary hemorrhage),⁸ depends on the position at which the examination is performed, the severity of the bruising, and the size and location of the injury. Thoracic computed tomography (CT) has higher diagnostic sensitivity,⁴ enabling the earlier diagnosis of traumatic pulmonary pseudocysts^{2,8} as well as the identification of other pulmonary lesions.² Other auxiliary diagnostic tests may be needed to better characterize lung lesions or to establish a differential diagnosis.

Prognosis is generally good, although complications such as superinfection, hemorrhage,^{1,4,8,10} secondary hemothorax,^{1,8} rupture,^{5,8} pneumothorax, or hemothorax¹⁰ may occur.² The likelihood of

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complications and the resolution time are higher in larger traumatic pulmonary pseudocysts (> 4 cm in diameter).⁸ Given that complications arise mainly within the first five days after trauma (between the first and ninth day), hospital surveillance is recommended during this period.² In the absence of complications, the only recommended treatment is conservative.^{4,7,11}

The diagnosis of traumatic pulmonary pseudocysts is, therefore, essential if unnecessary and potentially iatrogenic diagnostic and therapeutic procedures for the patient are to be avoided.⁸

We present the case of a 14-year-old adolescent with traumatic pulmonary pseudocysts associated with blunt thoracic trauma and highlight the challenges associated with the diagnosis and orientation.

Case Report

A 14-year-old male adolescent with mild cognitive impairment was admitted after being hit by a car and projected. He had a patent airway, requiring supplemental oxygen with a high-concentration mask at 9 L/min. for good peripheral oxygen saturation, pulmonary auscultation with a slight decrease of breath sounds on the side and hemodynamic stability. He was conscious, albeit disoriented, without focal neurological deficits and had multiple abrasions to the face, trunk, pelvic region, and limbs. In the initial analytical evaluation, leukocytosis (21,300 cells/ μ L) was noted with neutrophilia (17,300 cells/ μ L), C-reactive protein 0.11 mg/dL, and normal venous blood gas analysis. Chest radiograph showed a bilateral diffuse patchy infiltrate with a small pneumothorax in the upper right apex, with no evidence of rib fracture (Fig. 1). A head CT scan showed a right parietal epicranial hematoma. The remaining imaging exams (spine and pelvis radiograph, ultrasound of chest, abdomen and pelvis, CT scan of the cervical and dorsal spine) showed no changes. Due to the persistent need for supplemental oxygen up to 9 L/min. with a high-concentration mask, the chest radiography was repeated. In addition, a thoracic CT scan was performed about 26 hours after hospital admission, confirmed a small pneumothorax, and showed several areas of pulmonary parenchyma densification and other localized areas of gas density (in the right apex, apical segment of the lingula, medio-basal segment of the right lower lobe, and lateral segment of the middle lobe), some in relation to the tracheobronchial tree (Fig. 2). Due to the evidence of cavitary pulmonary lesions, in addition to the foci of contusion, a pre-existing non-traumatic condition was hypothesized, and he was

admitted for investigation and treatment. Relevant history, respiratory symptoms, or fever prior to the accident were ruled out. The diagnostic investigation (echocardiogram, human immunodeficiency virus, Mantoux test, quantiFERON, direct examination, culture and polymerase chain reaction for *Mycobacterium tuberculosis*) showed no abnormalities. The analytical evaluation was repeated eight days after the trauma. Blood count was normal, sedimentation rate 33 mm/h, C reactive protein 0.78 mg/dL, and normal venous blood gas analysis. During hospitalization, he had a low grade fever (maximum temperature 37.7°C), no signs of respiratory distress but requiring supplemental oxygen until the third day after trauma, and normal pulmonary auscultation from day nine. A chest radiography 10 days after the trauma also showed a diffuse patchy infiltrate with bilateral hypotransparent areas, especially on the periphery. Antibiotic therapy was administered for 21 days, initially with ceftriaxone and later on with oral amoxicillin and clavulanic acid. He was discharged 13 days after the trauma. After discharge, he was consistently asymptomatic, and the three-month control chest CT scan showed only a slight healing band in the upper third of the right lung (Fig. 3).

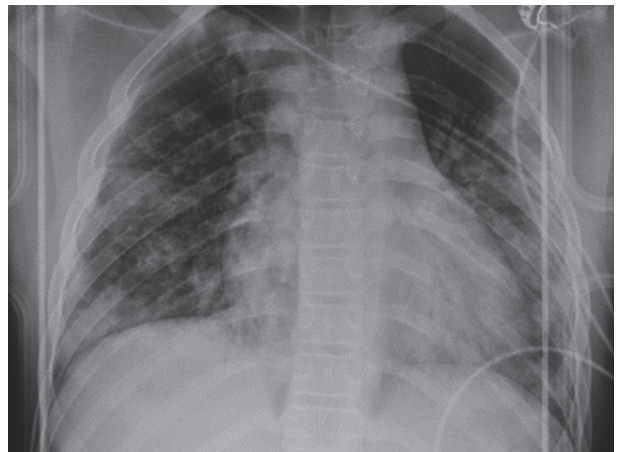


Figure 1. Chest radiography on admission.

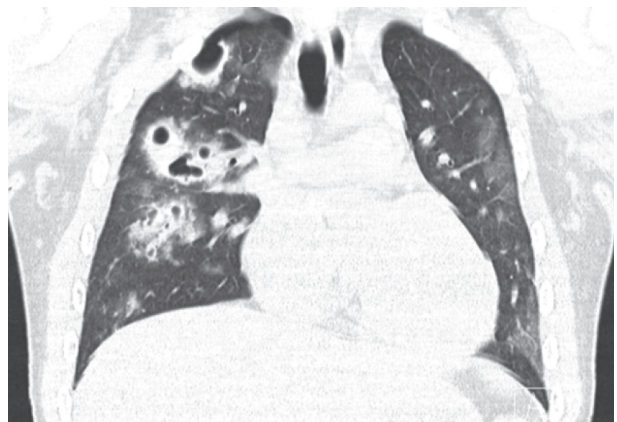


Figure 2. Gas density lesions detected in computed tomography.

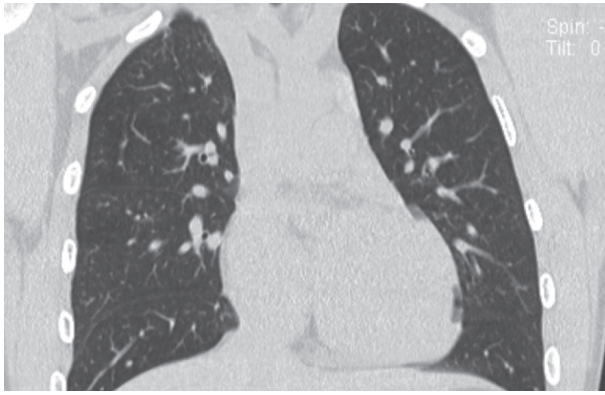


Figure 3. Control computed tomography after three months.

Discussion

The occurrence of traumatic pulmonary pseudocysts in this age group is in line with that described in the literature, as traumatic pulmonary pseudocysts occur before the age of 30 in about 85% of cases.^{3,4,7,8,10} They also appear to be more frequent in males, probably due to the higher frequency of car accidents^{5,8,10} and falls^{8,10} in this gender.

In this case, the only clinical manifestations were hypoxemia and changes in pulmonary auscultation. Symptoms can be subtle and non-specific,^{4,7} appearing up to seven days after trauma and being more frequent between 12 to 36 hours later.^{2,4} Chest pain, cough, hemoptysis, dyspnea,^{4,7,9,10} hypoxemia¹² and, more rarely, irritability and altered state of consciousness may occur.⁴ Low grade fever and leukocytosis may also occur, probably related to the absorption of damaged lung tissue or blood clots.^{4,7,8}

Chest radiographs showed no cavitary lesions and were not useful in the diagnosis. A chest radiograph has a sensitivity of 24% in detecting traumatic pulmonary pseudocysts.^{4,9} Only 50% of traumatic pulmonary pseudocysts diagnosed in CT are initially seen in chest radiographs.^{5,8,12} Diagnostic sensitivity increases around the fifth day after trauma, in relation to the complete development of the traumatic pulmonary pseudocysts and the imaging resolution of the contusions. In addition to these factors, it is more likely that the patient will be able to undertake orthostatic radiography a few days after the trauma.⁸

In turn, the sensitivity of thoracic CT ranges from 96%^{4,9} to 100%,² and is also important in differential diagnosis. However, it is not without radiation risk, especially in children, so its benefits should be considered on a case-by-case basis.⁵ In the present case, CT was performed in the first 24 hours after trauma, which allowed the identification of cavitary lesions at an early stage, although their characteristics were not useful in the etiological diagnosis.

Differential diagnosis of traumatic pulmonary pseudocysts includes entities that manifest with cavitary pulmonary lesions, including infectious ones such as tuberculosis, abscesses, pneumatoceles or cavities of fungal origin as well as neoplastic, vasculitic, or congenital diseases such as cystic adenomatoid malformation and bronchogenic cyst.^{2,4,7} In excluding other etiologies, the clinical history, characteristics of the lesions, and temporal relationship with the thoracic trauma should be taken into account, and other auxiliary diagnostic tests to clarify diagnosis are often necessary. Unlike other cavitated or cystic lesions, traumatic pulmonary pseudocysts change size, shape, and appearance^{2,3} over a relatively short time. If this does not happen, other etiologies should be considered.³

Regarding treatment, the use of antibiotics, justified in this case by the hypothesis of a previous pulmonary infectious pathology, is not routinely recommended. It may be necessary when there is suspicion of superinfection of the cavitary lesions^{2,8,13} or an increased risk of infection such as invasive ventilation.² Treatment is essentially supportive and conservative. Surgical treatment is reserved for large or persistent traumatic pulmonary pseudocysts, with antibiotic-resistant superinfection or unresponsive to drainage, active hemorrhage, or clinical deterioration.^{2,4,6} Traumatic pulmonary pseudocysts are usually self-limiting,^{1,7,10} with complete resolution within one to six months (average 1.8 months).^{1,2,8} The speed of resolution depends on the size and nature of the lesion,⁸ and air-filled lesions usually resolve faster than those that contain liquid.² Follow-up is recommended until full resolution.^{4,7} Imaging control may be done by chest radiograph, but since a CT scan is the best choice for characterizing lesions and identifying complications,² it was the exam chosen for imaging control of this patient. In this case, the clinical evolution and complete resolution of the cavitary lesions in the control CT support the diagnosis of traumatic pulmonary pseudocysts. As in the literature, the clinical and radiological evolution was very favourable, with only supportive treatment.^{4,7}

WHAT THIS CASE REPORT ADDS

- In case of thoracic trauma and with evidence of cavitary lung lesions, the diagnosis of traumatic pulmonary pseudocysts should be considered.
- The symptoms of traumatic pulmonary pseudocysts are subtle and non-specific.
- Awareness of this diagnosis prevents unnecessary diagnostic and therapeutic procedures from being performed.
- Most traumatic pulmonary pseudocysts are self-limiting lesions and conservative treatment is recommended in the absence of complications.

Conflicts of Interest

The authors declare that there were no conflicts of interest in conducting this work.

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Consent for publication

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Confidentiality of data

The authors declare that they have followed the protocols of their work centre on the publication of patient data.

References

1. Das S, Cherian SV, Bisen N, Hamarneh WA, Lenox R. Pulmonary cystic lesions post motor vehicle accident: A rare occurrence. *QJM* 2013;106:581-2. doi: 10.1093/qjmed/hcs101.
2. Hazer S, Orhan Söylemez U. Clinical features, diagnosis, and treatment of traumatic pulmonary pseudocysts. *Ulus Travma Acil Cerrahi Derg* 2018;24:49-55. doi: 10.5505/tjtes.2017.56023.
3. Kocer B, Gulbahar G, Gunal N, Koray Dural K, Sakinci U. Traumatic pulmonary pseudocysts: Two case reports. *J Med Case Rep* 2007;1:112. doi: 10.1186/1752-1947-1-112.
4. Matuszczak E, Oksiuta M, Hermanowicz A, Dębek W. Traumatic pneumatocele in an 11-year-old boy. Report of a rare case and review of the literature. *Kardiochir Torakochirurgia Pol* 2017;14:59-62. doi: 10.5114/kitp.2017.66934.
5. Armstrong LB, Mooney DP. Pneumatoceles in pediatric blunt trauma: Common and benign. *J Pediatr Surg* 2018;53:1310-2. doi: 10.1016/j.jpedsurg.2017.08.002.
6. Kaira K, Ishizuka T, Yanagitani N, Noriaki Sunaga N et al. Pulmonary traumatic pneumatocele and hematoma. *Jpn J Radiol* 2009;27:100-2. doi: 10.1007/s11604-008-0296-x.
7. Yang TC, Huang CH, Yu JW, Hsieh FC, Huang YF. Traumatic pneumatocele. *Pediatr Neonatol* 2010;51:135-8. doi: 10.1016/S1875-9572(10)60024-1.
8. Phillips B, Shaw J, Turco L, McDonald D, Carey J, Balters M, et al. Traumatic pulmonary pseudocyst: An underreported entity. *Injury* 2017;48:214-20. doi: 10.1016/j.injury.2016.12.006.
9. Cheung NK, James A, Kumar R. Large traumatic pneumatocele in a 2-year-old Child. *Case Rep Pediatr* 2013;2013:940189. doi: 10.1155/2013/940189.
10. De Dios JA, Paoletti L, Bandyopadhyay T. A 27-year-old man with pleuritic chest pain and hemoptysis after a rugby game. *Chest* 2009;136:1165-7. doi: 10.1378/chest.09-0598.
11. Houtman S, Janssen R. Traumatic pneumatoceles. *Neth J Crit Care* 2012;16:224-5.
12. Kolderman S, Fahrentholz S, JG Zijlstra JG. Pulmonary cavities after high energy trauma. *Neth J Crit Care* 2012;16:226-7.
13. Yazkan R, Ozpolat B, Sahinalp S. Diagnosis and management of post-traumatic pulmonary pseudocyst. *Respir Care* 2009;54:538-41.

Pseudoquistos Pulmonares Traumáticos: Um Desafio Diagnóstico

Os pseudoquistos pulmonares traumáticos são uma complicação pouco frequente de trauma torácico, ocorrendo, na maioria dos casos, antes dos 30 anos, devido à maior elasticidade da parede torácica. Podem ser identificados na radiografia do tórax, mas a tomografia computadorizada tem maior sensibilidade na detecção precoce e no diagnóstico diferencial. Apresenta-se o caso clínico de um adolescente de 14 anos que foi admitido por trauma torácico após atropelamento. A identificação de lesões quísticas na tomografia computadorizada torácica motivou a investigação de etiologia infecciosa e tromboembólica, que se revelou negativa. Estabeleceu-se o diagnóstico de pseudoquistos

pulmonares traumáticos, verificando-se resolução completa das lesões ao fim de três meses. Apesar de se tratar de uma entidade pouco frequente, os pseudoquistos pulmonares traumáticos devem ser equacionados perante um trauma torácico, de forma a evitar procedimentos diagnósticos e terapêuticos desnecessários. Na ausência de complicações, o tratamento é conservador e o prognóstico é favorável.

Palavras-Chave: Acidentes de Trânsito; Adolescente; Contusões/complicações; Diagnóstico Diferencial; Pneumopatias/diagnóstico por imagem; Pseudoquistos/etiologia; Tomografia Computorizada