

Traumatic pneumatocele in an 11-year-old boy – report of a rare case and review of the literature



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Abstract

The authors present a case of a pneumatocele associated with blunt trauma in a child. An 11-year-old boy was admitted to the emergency department after he was knocked over and his chest was trapped under a soccer goal. Chest computed tomography (CT) revealed several cavities in the lobes of both lungs. The CT of the abdomen revealed traumatic laceration of the liver. The patient was treated conservatively. His condition was stable and subsequently improved. He was discharged 19 days later. After nine months, a chest radiograph showed complete resolution of the pneumatocele, and abdominal ultrasound demonstrated complete resolution of the liver hematoma. A traumatic pneumatocele is a benign lesion resulting from blunt chest trauma, usually in children and young adults, which typically requires only conservative treatment. The CT scanning is the most sensitive method for the detection of traumatic pneumatoceles. All emergency physicians should be familiar with the diagnosis and management of this condition, to avoid unnecessary invasive procedures.

Key words: traumatic pneumatocele, lung, injury, blunt trauma, children.

Introduction

Traumatic pneumatoceles, which have also been reported as traumatic pulmonary pseudocysts or traumatic lung cysts, are a rare complication of blunt chest trauma (3.9% of pediatric blunt chest traumas) [1]. A pneumatocele is defined as a thin-walled air-filled cyst of the lung that is most often seen in children with bacterial pneumonia, but can also develop after blunt thoracic trauma, positive-pressure ventilation, or caustic aspiration [2]. The occurrence of a traumatic pneumatocele after a chest injury is rare; it requires a violent impact directed on a pliable chest wall (as seen in this age group), so that kinetic energy is transmitted to the underlying pulmonary parenchyma [3]. The condition is characterized by the appearance of pulmonary cavities with no epithelial lining, filled with air, fluid, or blood, which

Streszczenie

Autorzy przedstawiają przypadek torbieli powietrznej związanej z tępyim urazem u dziecka. Do szpitala przyjęto 11-letniego pacjenta po wydarzeniu, w trakcie którego upadł, a jego klatka piersiowa została przygnieciona przez bramkę do gry w piłkę nożną. Tomografia komputerowa klatki piersiowej uwidoczniła kilka komór w płatach lewego i prawego płuca. W tomografii komputerowej brzucha stwierdzono urazowe uszkodzenie wątroby. Pacjenta leczono zachowawczo; jego stan był stabilny i się poprawiał. Pacjenta wypisano po 19 dniach. Po 9 miesiącach w badaniu radiologicznym klatki piersiowej wykazano całkowite ustąpienie torbieli powietrznej, a w badaniu ultrasonograficznym brzucha – całkowite ustąpienie krwiaka wątroby. Urazowa torbiel powietrzna jest łagodną zmianą wynikającą z tępego urazu klatki piersiowej, występującą zazwyczaj u dzieci i młodych dorosłych, która wymaga zwykle jedynie leczenia zachowawczego. Tomografia komputerowa charakteryzuje się największą czułością w wykrywaniu urazowych torbieli powietrznych. Wszyscy lekarze ratunkowi powinni znać sposoby diagnozowania i zasady postępowania z torbielami powietrznymi, aby uniknąć niepotrzebnych zabiegów inwazyjnych.

Słowa kluczowe: urazowa torbiel powietrzna, płuco, uraz, uraz tępy, dzieci.

can be observed on radiological imaging. Pneumothorax or pneumomediastinum might also coexist. Any number of pneumatoceles can exist at any location except the apices [4]. The presence of a traumatic pneumatocele indicates that the tissue disruption is more extensive and the injury is more severe than a simple contusion [1, 5]. Clinical presentations, often observed within the first 3 to 7 days after injury, include chest pain, cough, hemoptysis, and dyspnea, as well as (rarely) irritability and mental changes [1, 5].

Chest radiography has been the traditional screening technique to evaluate thoracic trauma. Several reports have demonstrated that the sensitivity of computed tomography (CT) is much higher than that of X-ray in the detection of thoracic injuries such as traumatic pneumatoceles after trauma [6].

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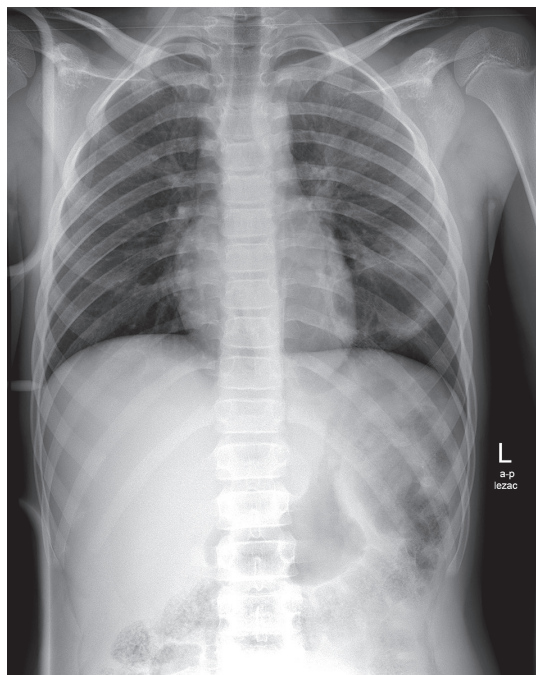


Fig. 1. Chest X-ray. A thin-walled bulla within the left lower lung field

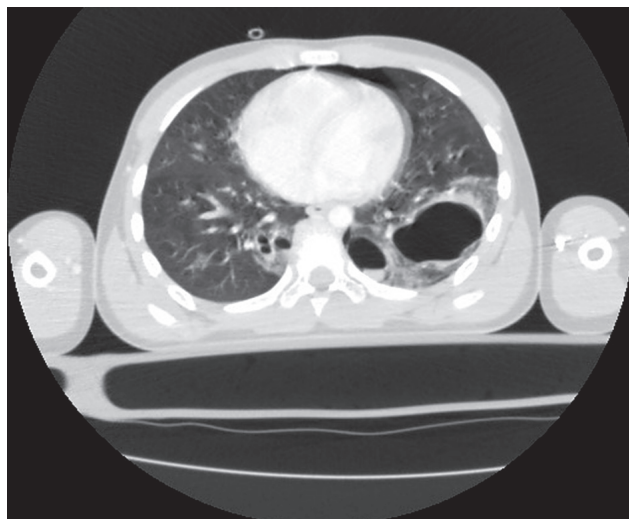


Fig. 2. Chest computed tomography on admission. A few thin-walled bullae with air-fluid levels in both lungs and pneumomediastinum

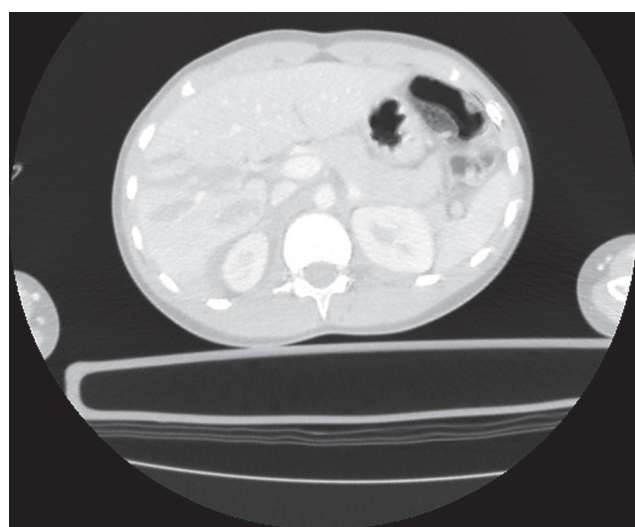


Fig. 3. Computed tomography of the abdomen on admission. Traumatic laceration of the liver: parenchymal disruption involving less than 50% of the right hepatic lobe with an intrahepatic hematoma

Case report

An 11-year-old boy presented to the emergency department after he was knocked over and his chest was trapped under a soccer goal. He was shocked on arrival and had bruising on the chest.

The patient was sent to our emergency department within 1 h, with clear consciousness. On physical examination, he was in a poor general state, but hemodynamically stable, except for tachypnea and tachycardia. There were several bruises over the right and left costal margins and abdominal wall. The abdomen was tense with diffuse tenderness. The extremities were freely movable. Auscultation revealed mild expiratory wheezing over both sides of the chest. Blood and biochemical tests showed an elevated leukocyte count of twenty thousand, and the results of liver function tests (AST and ALT) were elevated to over one thousand. A chest radiograph revealed heterogeneous consolidation in the left lung with a thin-walled cystic lesion (Fig. 1). There was no history of severe pneumonia or respiratory symptoms prior to the accident. Chest CT demonstrated focal areas of consolidation and several cavities over the posterior segments of the right and left lower lobes, with the biggest cavity within the left lobe (size: 90 × 20 mm; Fig. 2). There was an air-fluid level in the largest cavity, as well as minimal pneumomediastinum and minimal pneumothorax. The CT of the abdomen revealed traumatic laceration of the liver: parenchymal disruption involving less than 50% of the right hepatic lobe with an intrahepatic hematoma (Fig. 3). The patient was admitted to a pediatric ward. He was treated by observation and received broad-spectrum antibiotics. His condition was relatively stable and subsequently improved. He was discharged 19 days later, showing signs of spontaneous resolution of the lesions (residual liver hematoma: 33 × 38 × 35 mm; residual pneumatocele: 19 × 16 mm). The patient

The natural course of an uncomplicated traumatic pneumatocele is its complete resolution; therefore, conservative treatment is recommended [1, 7]. More complicated cases may give rise to questions concerning the optimal management, because not many pediatric cases are described in the literature. There are reports of complications associated with traumatic pneumatoceles, including secondary infection and hemoptysis [3, 8]. For complicated cases, complete resection is recommended [3, 9].

We present a rare case of a traumatic pneumatocele associated with blunt trauma in an 11-year-old boy.

was followed up by the surgical outpatient service. After 9 months, a chest radiograph showed complete resolution of the traumatic pneumatocele, and abdominal ultrasound demonstrated complete resolution of the residual liver hematoma.

Discussion

Traumatic pneumatoceles occur primarily in children and young adults; they are usually caused by non-penetrating chest trauma (mostly resulting from car accidents) or by continuous positive airway pressure during mechanical ventilation. According to the literature, 85% of patients were younger than 30 years [4]. Traumatic pneumatocele is generally classified as a benign condition representing more extensive tissue disruptions and injury severity than pulmonary contusions. Children and adolescents have a more compressible bony thorax than adults, and the elastic recoil of the lungs results in increased negative intrathoracic pressure leading to laceration. Only 20% of patients have associated rib fractures [2, 10]. The formed cavities filled with fluid, blood, or air continue to increase in size until a balance of lung pressures is achieved between the cavities and the surrounding tissue. Pneumatoceles may be single or multiple, uniloculated or multiloculated, elliptical or spherical cavities, and may be associated with pneumothorax or pulmonary contusion. The lung apices are usually spared [4].

The symptoms can be subtle and nonspecific (e.g., hemoptysis, chest pain, dyspnea, cough, mild fever, or leukocytosis), usually occurring 12 to 36 h after trauma [1, 5, 7]. The patients may suffer from mild fever and leukocytosis as a result of the absorption of damaged lung tissue or blood clots; this should not be misinterpreted as infection [4].

Chest X-ray has a low sensitivity (24%) in diagnosing pneumatoceles; CT is much more accurate, with a reported sensitivity of 96% [1, 11]. Although X-ray examinations may not show evidence of severe and lethal injuries or may yield false negative findings, they are still used as the first diagnostic modality in patients with thoracic trauma [6].

This is consistent with our case: the child's X-ray did not clearly identify a large pneumatocele, while chest imaging revealed multiple elliptical cavities in bilateral lung fields.

Pre-existing lung lesions, such as congenital cysts, post-pneumonia pneumatoceles, tuberculosis infection, pulmonary abscess, or cavitating pulmonary carcinoma should be ruled out [4]. In our patient, there was no history of severe pneumonia, or respiratory symptoms prior to the accident. None of his family members were carriers of tuberculosis. The chest trauma was located bilaterally, which corresponded to the location of the pneumatoceles. No previous chest radiographs had been taken.

Observation is the only treatment required if the patient has no other complications associated with the trauma. Conservative treatment is successful in most cases, with only a few reported complications such as infections, secondary hematoceles, respiratory deterioration, size increase, or failure to resolve [1, 5].

Prophylactic antibiotic usage is controversial and seems unnecessary in most patients. Pneumatoceles usually require several weeks to months to resolve on chest X-ray [4, 12]. In some cases, the pneumatocele may persist; therefore, follow-up is advocated until full resolution is demonstrated [4, 13]. In our case, the residual pneumatocele was resolved within 9 months, as shown by follow-up radiography.

The literature features reports of complications that can arise from large pneumatoceles (more than 4 cm in diameter), including infections, hematocele development, and respiratory compromise [1, 4, 7, 14, 15]. Current evidence favors surgical management for large and complex cases in order to prevent potential complications. Persisting cavities have been reported for large pneumatoceles managed conservatively, requiring thoracotomy at 6 months to correct the abnormalities [1, 16]. Infected lesions unresponsive to antibiotics and drainage, uncontrolled hemorrhaging, or clinical deterioration also require surgical treatment [2]. Akman *et al.* described a hematoma arising from a traumatic pneumatocele [17]. In such cases, magnetic resonance imaging can be useful for distinguishing a hemorrhage from other pathologies such as an inflammatory collection or abscess formation [2]. In our patient, after 9 months of observation and conservative treatment, we observed complete resolution of a large pneumatocele (90 × 20 mm in size).

Conclusions

A traumatic pneumatocele is a benign lesion resulting from blunt chest trauma, typically occurring in children and young adults, and usually requiring only conservative treatment. Surgical intervention is recommended only when complications such as infections and life-threatening conditions occur. The CT scanning is the most sensitive method for detecting traumatic pneumatoceles. All emergency physicians should be familiar with the diagnosis and management of this condition in order to avoid unnecessary invasive procedures.

Disclosure

Authors report no conflict of interest.

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