

Radiological Case Report / Caso Clínico

Pulmonary Hernia and Rib Fracture after Cough: Computed Tomography Diagnosis*Hérnia Pulmonar com Fractura de Costela após Crise de Tosse: Diagnóstico por Tomografia Computorizada***Luiz de Abreu Junior¹, Carlos Gustavo Yuji Verrastro², Ingredy Tavares da Silva³, Gleydson Martins de Matos³, Eduardo Werebe⁴**

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Abstract

The authors report a case of a 90-year-old male patient who presented with chest pain and bulging of the right chest wall after an intense coughing crisis. At physical examination, the bulging increased during expiration. The initial radiographic study did not reveal any significant change. Due to persistence of symptoms, Computed Tomography (CT) scan was performed, which revealed fracture of posterior 8th right rib and pleural effusion. As a result, a hernia of the right lung lower lobe secondarily developed, through the 8th enlarged right intercostal space. Based on this case, authors review etiological and pathophysiological aspects related to pulmonary hernias, highlighting the role of imaging methods in the diagnosis, as this condition may be clinically underdiagnosed.

Keywords

Hernia; Computed tomography; Lungs; Ribs.

Resumo

Os autores relatam o caso de um doente do sexo masculino de 90 anos de idade, que apresentou quadro de dor torácica e de saliência da parede torácica à direita após crise de tosse intensa, que se acentuava durante a expiração. O estudo radiográfico inicial não revelou alterações significativas. Pela persistência dos sintomas indicou-se o estudo por Tomografia Computorizada (TC) que revelou fractura da porção posterior da 8ª costela direita associado a derrame pleural. Esta alteração determinou secundariamente a formação de hérnia do lobo inferior do pulmão através do 8º espaço intercostal direito alargado. Através deste caso os autores fazem uma revisão dos aspectos etiológicos e fisiopatológicos relacionados com as hérnias pulmonares, que podem permanecer clinicamente subdiagnosticadas, destacando o papel dos métodos de imagem para o diagnóstico.

Palavras-chave

Hérnia; Tomografia computadorizada; Pulmão; Costelas.

Case History

90-year-old male patient, autonomous for daily living activities, with personal history of Chronic Obstructive Pulmonary Disease (COPD). He went to the emergency department for chest pain on the right, associated with respiratory distress, which appeared suddenly two days after an intense and long-lasting coughing crisis. The son who accompanied him observed that a protrusion had appeared on the right lateral chest wall that apparently changed in appearance while breathing.

Physical examination confirmed the presence of a protruding focus on the right lateral chest wall, with variation during the respiratory cycle. Upon palpation of this region, the patient reported significant pain.

On initial evaluation, a chest X-ray was performed, which did not reveal significant changes that could be detected.

As the symptoms persisted and in order to obtain a better assessment of the chest wall, computed tomography (CT) of the chest was requested.

The examination was performed in a CT device with multiple detectors (16 channels, Toshiba Aquilion), with volumetric acquisition, with slices obtained in the axial plane with 1 mm thickness, 0.5 mm increment, 120 Kvp

and 170 mAs. Iodinated contrast medium was not used intravenously. Multiple plan reconstructions and three-dimensional reconstructions were obtained using MIP (Maximum Intensity Projection) and Volume Rendering techniques.

The CT study revealed the presence of a fracture of the posterior portion of the right eighth rib (figure 1a), with slight misalignment of the bone fragments, which resulted in the widening of the eighth intercostal space (between the eighth and ninth ribs - figure 1b). Through this area of alteration of the chest wall, the CT study revealed the presence of hernia of the lower lobe of the right lung corresponding to the site of the alteration clinically identified (figures 2a, 2b and 3). There was also a small pleural effusion on the right (figure 2a). The patient was referred to the thoracic surgery service to schedule surgical correction.

Discussion

Pulmonary hernia or pneumocele is defined as the projection of part of the pulmonary parenchyma lined by the parietal and visceral pleura beyond its normal limits, usually due to a sudden increase in intra-thoracic pressure and occurring

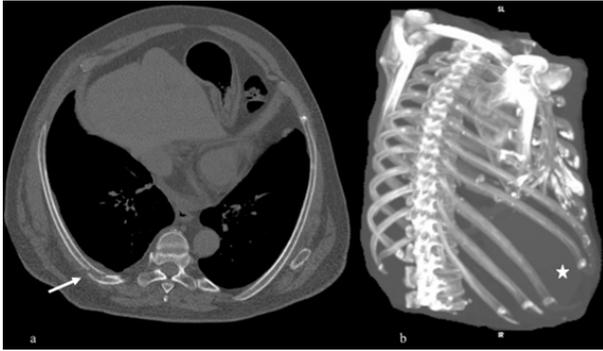


Figure 1 – Oblique axial reconstruction (1a), with bone window, indicating fracture of the posterior portion of the right eighth rib (arrow). Reconstruction with MIP technique (Maximum Intensity Projection - figure 1b) revealing enlargement of the eighth right intercostal space (asterisk).

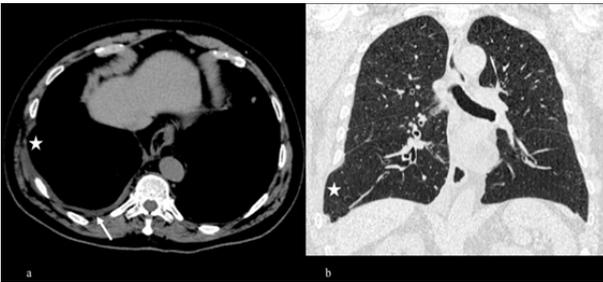


Figure 2 – Axial section in a mediastinal window (figure 2a) and coronal reconstruction with a window to assess the pulmonary parenchyma (figure 2b). Observe the presence of hernia of the lower lobe of the right lung through the enlarged intercostal space (asterisk in a and b). Presence of pleural effusion on the right (arrow in a).



Figure 3 – Three-dimensional reconstruction with volume rendering technique for lung and airway assessment. Observe the pulmonary hernia site of the right lower lobe, as shown in the 3D image (arrow).

through a defect in the chest wall.¹⁻³ Its classification was proposed in 1845 by Morel-Lavallée.⁴ The classification of pulmonary hernias considers two aspects: location and etiology. Regarding location they can be classified into cervical, diaphragmatic, thoracic and intercostal. From an etiological point of view, they can be classified as congenital or acquired, the latter being further subdivided into traumatic (including post-surgical), pathological (due to the presence of a previous lesion such as pleural empyema, rib osteomyelitis, tuberculosis or malignant lesion in the chest wall) or spontaneous. Approximately 80% of pulmonary hernias are acquired and 20% are of congenital origin, the latter usually resulting from disruption of the internal thoracic fascia. Spontaneous pulmonary hernias are quite rare.⁵

In terms of location, intercostal pulmonary hernias represent the most frequent type (as in the present case), followed by cervical hernias and more rarely diaphragmatic pulmonary hernias. A common site of intercostal pulmonary hernias is the chest wall between the eighth and ninth ribs, since in this location there is an absence of the

external (on the anterior wall) and internal (on the posterior wall) intercostal muscles.^{1,2}

Most of the time, patients have some associated risk factor, including chronic obstructive pulmonary disease (COPD), history of previous thoracotomy, osteoporosis, chest trauma and obesity.¹⁻³

Clinically, individuals with pulmonary hernias may be asymptomatic. When symptoms are present, the main complaint is acute chest pain. Upon examination, it is possible to identify bruises at the herniation site and eventually the presence of a mass that is accentuated with the Valsalva maneuver, on expiration or while coughing.

In the face of clinical suspicion, a study with an imaging method is usually necessary to assess the possible presence of this alteration. Chest radiography may be the initial examination in this context. The finding of a normal radiographic study is common in this situation and its presence should not be ruled out. When altered, signs of enlargement of an intercostal space with lung projection beyond the limits of the rib cage (lung beyond rib sign) can be identified.^{1,2,7}

The most suitable diagnostic test for the evaluation of pulmonary hernias is chest CT. This exam allows a complete assessment of all possible changes present in pulmonary hernias, namely:

- Identification of the presence, nature and extent of the chest wall deficiency;
- Identification of the precise location of the involved pulmonary segment and evaluation of the size of the herniated segment;
- Assessment of possible complications, such as pneumothorax, pleural effusion, pneumomediastinum, etc.

The information derived from the CT study, especially when performed on a device with multiple detectors, can be of great value for the preoperative evaluation and for surgical programming, in cases where this is indicated.^{1,7,8} The study carried out with volumetric acquisition allows for subsequent reconstructions in multiple and three-dimensional (3D) planes with high resolution, allowing a detailed preoperative evaluation, namely of the chest wall. The patient in this report had a fracture of the posterior portion of the eighth right costal arch, with consequent enlargement of the intercostal space and pulmonary herniation, changes that are well demonstrated in multiplanar and three-dimensional reconstructions (figures 2 and 3). Remember the possibility of obtaining tomographic images during the Valsalva maneuver or during expiration, which can accentuate the projection of the lung tissue beyond the limits of the chest wall where it has been altered (figure 4).



Figure 4 – Axial sections with high-resolution inhalation (a) and exhalation (b) techniques at the same level as the lower lobes. It is possible to observe a greater protrusion of the right lower lobe at the enlargement site of the chest wall in the image acquired on expiration (arrow in b).

The treatment of pulmonary hernias can be conservative, with only a local bandage for immobilization and is indicated for asymptomatic and oligosymptomatic patients or for those with small hernias. Surgery is indicated when conservative treatment fails in oligo / asymptomatic patients and in symptomatic patients, those with very large hernias or when there are associated complications. Surgery may also be indicated for aesthetic reasons. The technique varies between herniorraphy with non-absorbable thread

or hernioplasty with autologous tissue (muscles or fascia lata) or even with the use of synthetic material.^{2,3,12}

In conclusion, it is important that the radiologist knows the main types of pulmonary hernias and the risk factors that determine their appearance. CT is a very important exam for the diagnosis of this condition and allows gathering relevant information for surgical programming, when indicated.

Received / Recebido 20/04/2020

Acceptance / Aceite 14/07/2020

Ethical disclosures / Divulgações Éticas

Conflicts of interest: The authors have no conflicts of interest to declare.

Conflitos de interesse: Os autores declaram não possuir conflitos de interesse.

Financing Support: This work has not received any contribution, grant or scholarship.

Supporte financeiro: O presente trabalho não foi suportado por nenhum subsídio ou bolsa.

Confidentiality of data: The authors declare that they have followed the protocols of their work center on the publication of data from patients.

Confidencialidade dos dados: Os autores declaram ter seguido os protocolos do seu centro de trabalho acerca da publicação dos dados de doentes.

Protection of human and animal subjects: The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Proteção de pessoas e animais: Os autores declaram que os procedimentos seguidos estavam de acordo com os regulamentos estabelecidos pelos responsáveis da Comissão de Investigação Clínica e Ética e de acordo com a Declaração de Helsínquia da Associação Médica Mundial.

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