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CASE REPORT

Pneumomediastinum and pneumopericardium, a rare complication of asthma: a case report

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asthma; subcutaneous emphysema; tomography; mediastinal emphysema; pneumomediastinum diagnosis (Source: MeSH - NLM).

ABSTRACT

Pneumomediastinum is a relatively uncommon condition characterized by the presence of free air in the mediastinum that is not caused by surgery, a medical procedure, or trauma. An infrequent cause of pneumomediastinum is an asthma attack; furthermore, in certain situations, the air that reaches the mediastinum can spread to the pericardium and generate a pneumopericardium. The objective of this article is to document the clinical presentation, diagnosis, and treatment of pneumomediastinum and pneumopericardium in the context of an asthma exacerbation, aiming to provide healthcare professionals with tools to accurately manage these patients. To illustrate this, we present the case of a male patient who developed pneumomediastinum and pneumopericardium during an asthma attack.

Neumomediastino y neumopericardio, una rara complicación del asma: a propósito de un caso

Palabras clave:
asma; enfisema subcutáneo; tomografía; enfisema mediastínico; diagnóstico de neumomediastino (Fuente: DeCS - BIREME).

RESUMEN

El neumomediastino es una patología relativamente infrecuente en la que hay presencia de aire libre en el mediastino que no se debe a una cirugía, un procedimiento médico o trauma. Una causa infrecuente del neumomediastino es la crisis asmática; además, en ciertas situaciones, el aire que llega al mediastino puede disecar el pericardio y generar un neumopericardio. El objetivo de este artículo es documentar la presentación clínica, diagnóstico y tratamiento del neumomediastino y neumopericardio en el contexto de una exacerbación asmática con el fin de brindar herramientas a los profesionales de la salud para atender a estos pacientes de forma certera. En este sentido, se presenta el caso de un paciente masculino que presentó un neumomediastino y neumopericardio en el contexto de una crisis asmática.

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INTRODUCTION

Asthma is a chronic disease of the airways, characterized by an exaggerated bronchial response and a variable and reversible airflow obstruction. Asthma exacerbation is defined by a worsening of symptoms, typically manifested as dyspnea, chest tightness, and cough [1].

A rare complication of asthma exacerbations is pneumomediastinum, which refers to the presence of free air in the mediastinum, typically caused by alveolar rupture due to increased intra-alveolar pressure. This air may also reach the subcutaneous tissue, face, neck, retropharyngeal space, and even dissect the pericardium, causing pneumopericardium. Both pneumomediastinum and pneumopericardium generally follow a benign course, so treatment is primarily supportive. The literature and studies regarding pneumomediastinum and pneumopericardium in asthmatic patients are limited, thus case reports contribute to the medical literature by enhancing the understanding of these cases [2].

We present the case of a 24-year-old male patient with an asthma exacerbation treated with bronchodilators and corticosteroids, in whom pneumomediastinum and pneumopericardium were documented. After three days of hospitalization, the patient showed good clinical progress and was discharged.

CASE PRESENTATION

A 24-year-old male patient with a history of vitiligo and asthma not under medical treatment, whose last asthma exacerbation occurred 10 years ago without requiring hospitalization, presented to the Urgent Care Department with a 4-day history of nasal congestion, dysgeusia, anosmia, cough with greenish-yellow expectoration, and an episode of unquantified fever. He also reported respiratory difficulty and exertional dyspnea. On physical examination, he was normotensive (128/81 mmHg), tachycardic (110 bpm) and oxygen saturation was 94% on room air. He presented with tachypnea, and auscultation revealed generalized hypoventilation and expiratory wheezing, along with subcutaneous emphysema in cervical zones I and II. Upon admission to the Urgent Care Department, laboratory tests showed a complete blood count without alterations in the three cell lines, arterial blood gases without acid-base or oxygenation imbalance, a normal electrocardiogram, negative viral respiratory panel, and negative SARS-CoV-2 antigen and PCR tests.

Chest X-ray (see Figure 1) revealed pneumomediastinum, pneumopericardium, and subcutaneous emphysema. For better characterization of these findings, a chest computed tomography (CT) scan was performed (see Figure 2), showing extensive pneumomediastinum dissecting the pericardium and peribronchovascular emphysema. The pneumomediastinum and pneumopericardium were attributed to the Macklin effect, which is the result of air leakage into the pulmonary interstitium caused by alveolar rupture. This air dissects along the bronchovascular sheaths until it reaches the mediastinum, where it accumulates and causes pneumomediastinum [3].

During hospitalization, the patient was treated with methylprednisolone, short-acting inhalers, and oxygen therapy. After three days of observation, due to significant symptomatic improvement, the patient was discharged with MART therapy (low-dose formoterol-budesonide) for outpatient management.

DISCUSSION

Spontaneous pneumomediastinum is a relatively uncommon condition characterized by the presence of free air in the mediastinum not attributable to surgery, medical procedures, or trauma. Its actual incidence is difficult to determine, as most data come from case reports; however, it has been estimated to occur in 1 out of every 25,000 individuals and is found in 1 out of every 40,000 Urgent Care Department visits. It most commonly affects young individuals in their second and third decades of life, with males accounting for 75% of cases [4,5].

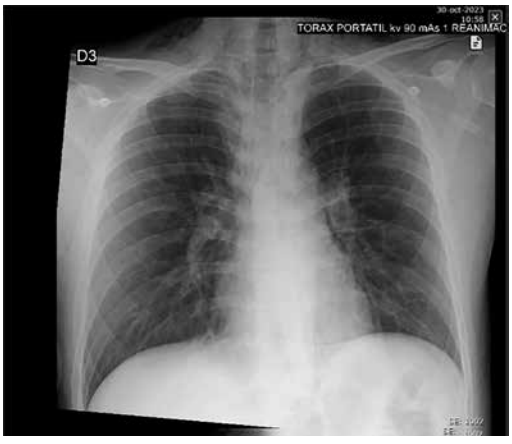

Figure 1. Portable chest X-ray: pneumopericardium and pneumomediastinum, as well as subcutaneous emphysema in the soft tissues of the cervical region and right thoracic wall

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Figure 2. Chest CT scan: extensive pneumomediastinum dissecting the epicardial tissues is visualized. Gas is present in the peribronchovascular perihilar and intrafissural spaces on the left, with interstitial emphysema predominantly in the left lower lobe. Emphysema is also observed in the soft tissues of the thoracic wall and neck

According to a review of six case series including 201 patients with spontaneous pneumomediastinum, the most common associated symptoms were chest pain (present in up to 75% of cases), dyspnea (49%), cough (36%), and neck pain (36%). Less frequent symptoms include dysphagia, odynophagia, dysphonia, weakness, and back pain. The most frequent physical examination finding was subcutaneous emphysema, observed in 58% of cases. Hamman's sign—crepitant or crunching sounds synchronous with the heartbeat—was present in only approximately 18% of cases [6].

Spontaneous pneumomediastinum is caused by increased intra-alveolar pressure, which leads to alveolar rupture and migration of air from the alveolar space into the hila and interstitium. From there, air may reach the mediastinum and pericardium. Once in the mediastinum, the air can extend to the face, neck, retro-pharyngeal space, and even into the epidural space, as described in some case reports—a process known as the Macklin effect. Predisposing factors that increase intrathoracic and therefore intra-alveolar pressure include intrinsic pulmonary and airway diseases such as chronic obstructive pulmonary disease (COPD), asthma, pulmonary fibrosis, and bronchiectasis. Extrinsic factors such as tobacco use, illicit drug use (cocaine, marijuana, methamphetamines), vomiting, severe coughing, Valsalva maneuvers, and esophageal perforation also contribute to the development of this condition [2,7,8].

Spontaneous pneumomediastinum can be diagnosed with simple chest X-rays in 69% to 100% of cases, and subcutaneous emphysema is detectable in 35% to 65.8% of cases. Gas outlining mediastinal structures (double contour of the mediastinum), elevation of the mediastinal pleura, the continuous diaphragm sign, and the Spinnaker sail sign in children (indicating displacement of the thymic lobes by mediastinal air) are some of the radiographic features. A lateral neck X-ray is often more sensitive than the anteroposterior chest view. While a chest X-ray may suffice in most cases, CT scans provide superior diagnostic performance and are preferred when clarification of etiology or assessment of the pneumomediastinum's extent is needed [8–10].

The incidence of pneumomediastinum in asthmatic patients is unknown. Vianello et al. [11] published a case series of 45 patients with severe asthma exacerbations, in which 11% had spontaneous pneumomediastinum. In asthmatic patients, increased alveolar pressure resulting in alveolar rupture may be secondary to the characteristic bronchospasm of the disease. Pneumomediastinum should be suspected in asthma patients who present with chest pain, subcutaneous emphysema, or a stationary clinical course despite optimal medical management.

Pneumomediastinum usually has a benign course, with an average hospital stay of five days, and often resolves spontaneously within 5 to 7 days. Therefore, treatment is generally conservative, including rest, analgesia, bronchodilators, and oxygen therapy. Oxygen is particularly beneficial as it increases nitrogen diffusion from the interstitium, promoting the rapid absorption of free air [9,12].

However, in rare cases, life-threatening complications may arise, such as tracheal compression, respiratory distress, tension pneumomediastinum, or tension

pneumothorax. In such exceptional cases, more invasive decompression measures may be required, such as cutaneous or subcutaneous incisions, needle or catheter aspiration, or, ultimately, cervical mediastinotomy, which is considered the most effective intervention [13–15].

Pneumopericardium refers to the presence of air in the pericardial sac, which may be potentially fatal [16]. It is a rare condition, with no definitive incidence data. It generally results from the dissection of air into the pericardial tissue, primarily due to high-impact trauma [17]. In a study of 46,389 trauma patients, only 488 had pneumopericardium [18]. The occurrence of pneumopericardium during an asthma exacerbation is even more rare. In a study of 10,472 children with asthma exacerbations, only 0.2% (21 patients) developed pneumopericardium [19]; adult data are not available.

Like pneumomediastinum, pneumopericardium presents in 80–90% of cases with retrosternal chest pain and in 50% with dyspnea [16]. Depending on the severity of the lesion, the patient may present signs of hemodynamic instability, cardiac tamponade (e.g., pulsus paradoxus), or Bruit Moulin—a sound produced by the movement of air and fluid in the pericardial space. This murmur, seen in complicated pneumopericardium, is described as a fluctuating precordial sound similar to a grinding mill, hence its French name "Bruit Moulin" [19].

In the context of pneumopericardium, the electrocardiogram is often normal but may show nonspecific findings such as sinus tachycardia, atrial fibrillation, ST segment and T wave changes resembling pericarditis, and signs suggestive of tamponade such as low voltages. Echocardiography may reveal artifacts, including comet-tail artifacts, due to the interposition of air between the heart and the probe [21]. On chest X-ray, a radiolucent band outlining the left ventricle and right atrium may be seen, while chest CT offers better characterization of the condition [22].

Once pneumopericardium is confirmed, the patient should be closely monitored due to the risk of cardiac tamponade—a complication reported in up to 37% of cases. If tamponade occurs, immediate decompression is required. However, this percentage corresponds to a series of 294 cases of trauma-induced pneumopericardium [23]. The frequency of cardiac tamponade in pneumopericardium secondary to asthma exacerbation is unknown.

In the absence of hemodynamic compromise, management involves treating the underlying cause, if present. Symptomatic management includes analgesia, rest, avoidance of Valsalva maneuvers, and oxygen therapy to promote air reabsorption.

Conclusion

Pneumomediastinum is a relatively rare complication of asthma that must be considered in the differential diagnosis. If there is high clinical suspicion, a chest X-ray should be performed; however, a negative result does not rule out the diagnosis. In persistent cases, a chest CT scan is recommended. The course of pneumomediastinum in asthmatic patients is usually benign, so treatment is generally supportive. Nevertheless, urgent decompressive measures may be necessary in exceptional cases.

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Authorship contribution

MVM: Conceptualization, Data curation, Writing – original draft.

JSG: Conceptualization, Data curation, Writing – original draft.

EMRN: Data curation, Writing – original draft.

APAG: Supervision, Writing – review & editing, Validation.

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The authors declare no conflicts of interest.