Spontaneous pneumomediastinum in a young adult female

Luiza Chimeli-Ormonde[1*], Lúcia Helena Ferreira Vasconcelos[1], Roberto Rangel Alves Silva[1], Patricia Sanson Pereira Bastos[2]

1. Hospital Municipal Ronaldo Gazolla - Av. Pastor Martin Luther King Júnior, 10.976 - Acari, Rio de Janeiro - RJ, 21531-010, Brazil

2. Hospital Federal da Lagoa - R. Jardim Botânico, 501 - Jardim Botânico, Rio de Janeiro - RJ, 22470-050, Brazil

* **Correspondence:** Luiza Chimeli-Ormonde, Institution and postal mail: Hospital Municipal Ronaldo Gazolla - Av. Pastor Martin Luther King Júnior, 10.976 - Acari, Rio de Janeiro - RJ, 21531-010, Brazil
(*coluiza@gmail.com*)

Radiology Case. 2022 Oct; 16(10):8-13 :: DOI: 10.3941/jrcr.v16i10.4565

ABSTRACT

Spontaneous pneumomediastinum is characterized by the accumulation of air in the mediastinum with no identified cause. It is a rare and self-limiting condition. We report the case of a 32-year-old female patient with controlled bronchial asthma, who presented with spontaneous pneumomediastinum, with no precipitating event. The evolution is generally benign and the treatment is conservative. Symptomatic medication may be instituted.

CASE REPORT

CASE REPORT

A 32-year-old mixed-ethnicity female, lawyer, nulliparous, newly diagnosed with type 2 diabetes mellitus, with bronchial asthma without crises for 5 years, using oral contraceptives, was referred to a public hospital in a suburb of Rio de Janeiro. The patient reported a runny nose, headache, unmeasured fever, and chills starting a few days after working long hours for 3 consecutive days. She denied coughing or vomiting. She developed a fever of 38°C; stabbing chest pain; dyspnea at rest, which worsened in the supine position; paresthesia; edema in the face and cervical region (initially unilateral, with bilateral evolution); and dysphagia. She reported a progression of the edema, extending asymmetrically to the chest until below the nipple line, sparing her upper limbs and with crepitation upon touch. On admission, her vital signs were as follows: blood pressure 147/89 mmHg, axillary temperature 36.5°C, oxygen saturation 99% in room air, heart rate 89 bpm, respiratory rate 21 bpm, and blood glucose 120 mg/dL. The antigen test for COVID-19 was negative. General examination revealed no apparent distress, she was alert and oriented in time and space, eupneic in room air, ruddy, hydrated, anicteric, and acyanotic, with facial edema extending to the thorax. Head and neck showed swelling with crepitation on superficial palpation; chest with reduced breath sounds in both bases, with absence of wheezing, rhonchi, or crackles. Examination of the heart, abdomen, and lower limbs revealed no abnormalities. A complete blood count, urinalysis, and chest computed tomography (CT) were performed. Chest tomography revealed subcutaneous emphysema with pneumomediastinum, with no other noteworthy changes (Figures 1, 2, and 3). The patient denied alcoholism, smoking, drug use, surgeries, invasive procedures, falls, trauma, COVID-19, tuberculosis, digestive system diseases, and strenuous exercise. Conservative treatment was provided including bed rest, salbutamol puff 3 times a day, 10 mg dexamethasone once a day, and administration of a mucolytic. One week after the onset of the condition, she reported a spontaneous progressive reduction of the subcutaneous emphysema and improvement of dyspnea, and she began to tolerate dorsal decubitus. The patient was discharged from the hospital.

DISCUSSION

Etiology & Demographics:

Pneumomediastinum is a rare condition (1 per 7,000–12,000 hospital admissions [1]) characterized by the accumulation of air in the mediastinum, first described by Laennec in 1829 [2]. Some causes include esophageal perforation and traumatic thoracic and esophageal injuries. When it occurs without an apparent cause, such as trauma or iatrogenesis, it is termed spontaneous pneumomediastinum [3,4]. This occurs due to an increase in intrathoracic pressure that results in alveolar rupture and air leakage from the airways into the mediastinum [5]. The pathophysiology of this event, involving a pressure gradient that results in the rupture of alveolar bases, followed by air dissection along the bronchovascular sheaths and air accumulation in the mediastinum, was described by Macklin in 1939 [6].

This condition is more commonly found in males (2.7 males: 1 female) [7] between 20 and 30 years of age [8] (Table 1). Our study describes the case of a female patient in approximately the same age group (32 years old).

Clinical & Imaging findings:

The signs and symptoms presented are compatible with those described in the literature such as chest pain, dyspnea, cervical edema, and dysphagia [7,8].

Most patients affected by spontaneous pneumomediastinum also have subcutaneous emphysema [8], as found for our patient.

Spontaneous pneumomediastinum can be precipitated by coughing, emesis, intense physical exercise, labor, upper-airway infection, and diabetic ketoacidosis [7]. However, we did not identify any factors that could be related to the case in question. Despite having been recently diagnosed with type 2 diabetes mellitus, both the hemoglucotest and blood glucose did not show changes compatible with severe glycemic disorders.

Some risk factors include athletic physical activity, drug use [9], asthma, and smoking [7] (Table 1). The patient in question has no evident risk factors, other than a report of having bronchial asthma, although without attacks for 5 years.

Chest radiography has been widely used in the diagnosis of spontaneous pneumomediastinum, with 83% sensitivity [9]. Typical findings include lucent streaks in the mediastinum, large collections of air delineating mediastinal structures, and air bubbles [10]. Subcutaneous emphysema is often associated [9,10] (Table 1). However, a chest CT offers a more accurate view of the gas distribution and can help elucidate the etiology [9,10]. In this patient, images of a chest CT show small collections of air between the heart and the sternum (Figures 2 and 3), and subcutaneous emphysema on the chest and around the neck (Figure 1), corroborating the diagnosis.

Treatment & Prognosis:

It is a self-limiting condition, difficult to diagnose, whose treatment is controversial and generally conservative, involving rest, analgesia, bronchodilator, and steroids [8], as performed in the present case.

Differential Diagnoses:

Spontaneous pneumomediastinum must be distinguished from common diagnoses that also present with chest pain and dyspnea. Among them are cardiovascular, pulmonary, and esophageal diseases [11]. It is important to highlight that thoracic trauma should also be taken into account in the diagnostic investigation. Here, we present the main differential diagnoses of spontaneous pneumomediastinum: esophageal perforation, pericarditis, and tension pneumothorax (Table 2).

Esophageal perforation (Boerhaave's Syndrome)

Chest pain and subcutaneous emphysema are also found in Boerhaave's syndrome, which consists of esophageal rupture due to increased intraesophageal pressure, and lack of cricopharyngeal sphincter relaxation [12]. However, unlike spontaneous pneumomediastinum, in Boerhaave's syndrome these findings are usually accompanied by a history of vomiting (Mackler triad). Dyspnea, cough, sore throat, dysphonia, dysphagia, palpitations, and neck pain may be present [13]. It is a rare and dangerous condition due to the extravasation of gastric contents into the mediastinum and pleura, leading to infection and death [12,14]. Chest X-ray findings include interposition of air between the heart and the diaphragm, thymus elevation by air, and subcutaneous emphysema [13,14]. Pleural effusion, pneumothorax, and costophrenic opacity may be present. Contrast-enhanced X-ray aids in detecting esophagus perforation. When the diagnosis is questionable, contrast-enhanced computed tomography may be useful. Paraesophageal abscess can be found, due to chemical mediastinitis and bacterial infection [13] (Table 2).

Pericarditis

Pleuritic chest pain that worsens with inspiration and improves in a forward-bent sitting position is present in most cases of acute pericarditis, which is another differential diagnosis of spontaneous pneumomediastinum [15]. However, the former usually presents with chest pain associated with auscultation of pericardial rubs, pericardial effusion, and electrocardiography changes [16]. Pericarditis is an inflammatory heart condition, usually benign, self-limiting, of viral etiology, and more common in young men [15]. Radiological imaging may be helpful when there is diagnostic doubt. Chest X-ray is frequently normal unless pericardial effusion exceeds 300 mL, resulting in an enlarged cardiac area. CT scan shows pericardial thickening and aids in surgical planning [16]. Unlike spontaneous mediastinum, pericarditis presents with no signs of gas in the mediastinum (Table 2).

Tension Pneumothorax

Tension pneumothorax is a life-threatening condition derived from a complication of spontaneous pneumothorax. The latter usually presents with pleuritic chest pain and dyspnea [17], which are also symptoms of spontaneous pneumomediastinum. However, if not treated promptly, spontaneous pneumothorax can evolve to tension pneumothorax, which occurs when a one-way valve is created between the lung and the pleura, leading to air accumulation in the pleural cavity [18]. Hypoxemia, mediastinal shift, and reduced venous return are often found in these cases [18].

Radiological findings include collapsed lung, pneumothorax, and enlarged jugular veins [18] (Table 2).

TEACHING POINT

Spontaneous pneumomediastinum is a rare and benign condition, often associated with subcutaneous emphysema. It is generally a self-limiting condition that must be discriminated from other diagnoses, especially esophageal perforation.

REFERENCES

1. Gerazounis M, Athanassiadi K, Kalantzi N, Moustardas M. Spontaneous pneumomediastinum: a rare benign entity. J Thorac Cardiovasc Surg. 2003;126(3):774-6. PMID:14502153

2. Laennec RT. A treatise on the diseases of the chest and on mediate auscultation. 3rd ed. London: Thomas & George Underwood; 1829. Pp. 152-178. ISBN:9780259653080

3. Flatman S, Morrison E, Elahi M. Spontaneous pneumomediastinum associated with sex. J Radiol Case Rep. 2010;4(4):25-9. PMID:22470723

4. Javan R, Duszak R, Tonkin K. Spontaneous pneumomediastinum due to achalasia: an unusual but benign cause. J Radiol Case Rep. 2010;4(11):38-43. PMID:22470701

5. Hamman L. Spontaneous mediastinal emphysema. Bull Johns Hopkins Hosp. 1939;64:1-21. ISSN:0097-1383

6. Macklin CC. Transport of air along sheaths of pulmonic blood vessels from alveoli to mediastinum: clinical implications. Arch Intern Med (Chic). 1939;64(5):913-26. ISSN:0730-188X

7. Morgan CT, Maloney JD, Decamp MM, Mccarthy DP. A narrative review of primary spontaneous pneumomediastinum: a poorly understood and resource-intensive problem. J Thorac Dis. 2021;13(6):3721-30. PMID:34277063

8. Alemu BN, Yeheyis ET, Tiruneh AG. Spontaneous primary pneumomediastinum: is it always benign? J Med Case Rep. 2021;15(1):157. PMID:33761988

9. Dajer-Fadel WL, Argüero-Sánchez R, Ibarra-Pérez C, Navarro-Reynoso FP. Systematic review of spontaneous pneumomediastinum: a survey of 22 years' data. Asian Cardiovasc Thorac Ann. 2014;22(8):997-1002. PMID:24887879

10. Bejvan SM, Godwin JD. Pneumomediastinum: old signs and new signs. AJR Am J Roentgenol. 1996;166:10418. PMID:8615238

11. Dionísio P, Martins L, Moreira S, Manique A, Macedo R, Caeiro F, Boal L, Bárbara C. Spontaneous pneumomediastinum: experience in 18 patients during the last 12 years. J Bras Pneumol. 2017;43(2):101-5. PMID:28538776

12. Wang J, Wang D, Chen J. Diagnostic challenge and surgical management of Boerhaave's syndrome: a case series. J Med Case Rep. 2021;15(1):553. PMID:34749789

13. Forshaw MJ, Khan AZ, Strauss DC, Botha AJ, Mason RC. Vomiting-induced pneumomediastinum and subcutaneous emphysema does not always indicate Boerhaave's syndrome: report of six cases. Surg Today. 2007;37(10):888-92. PMID:17879041

14. Hashmi MAR, El-Badawy M, Agha A. Suspecting a fatal condition on a plain chest radiograph; Boerhaave syndrome. Scott Med J. 2021;66(1):46-8. PMID:32981463

15. Lazarou E, Tsioufis P, Vlachopoulos C, Tsioufis C, Lazaros G. Acute Pericarditis: Update. Curr Cardiol Rep. 2022;20:1-9. PMID:35595949

16. Adler Y, Charron P, Imazio M, Badano L, Barón-Esquivias G, Bogaert J, Brucato A, Gueret P, Klingel K, Lionis C, Maisch B, Mayosi B, Pavie A, Ristic AD, Sabaté Tenas M, Seferovic P, Swedberg K, Tomkowski W; ESC Scientific Document Group. 2015 ESC Guidelines for the diagnosis and management of pericardial diseases: The Task Force for the Diagnosis and Management of Pericardial Diseases of the European Society of Cardiology (ESC) Endorsed by: The European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J. 2015;36(42):2921-64. PMID:26320112

17. Mendogni P, Vannucci J, Ghisalberti M, Anile M, Aramini B, Congedo MT, Nosotti M, Bertolaccini L; Collaborators of the Pneumothorax Working Group, on behalf of the Italian Society for Thoracic Surgery (endorsed by the Italian Ministry of Health) Collaborators of the Pneumothorax Working Group, D'Ambrosio AE, De Vico A, Guerrera F, Imbriglio G, Pardolesi A, Schiavon M, Russo E. Epidemiology and management of primary spontaneous pneumothorax: a systematic review. Interact Cardiovasc Thorac Surg. 2020;30(3):337-45. PMID:31858124

18. Yoon JS, Choi SY, Suh JH, Jeong JY, Lee BY, Park YG, Kim CK, Park CB. Tension pneumothorax, is it a really life-threatening condition? J Cardiothorac Surg. 2013;8:197. PMID:24128176

FIGURES

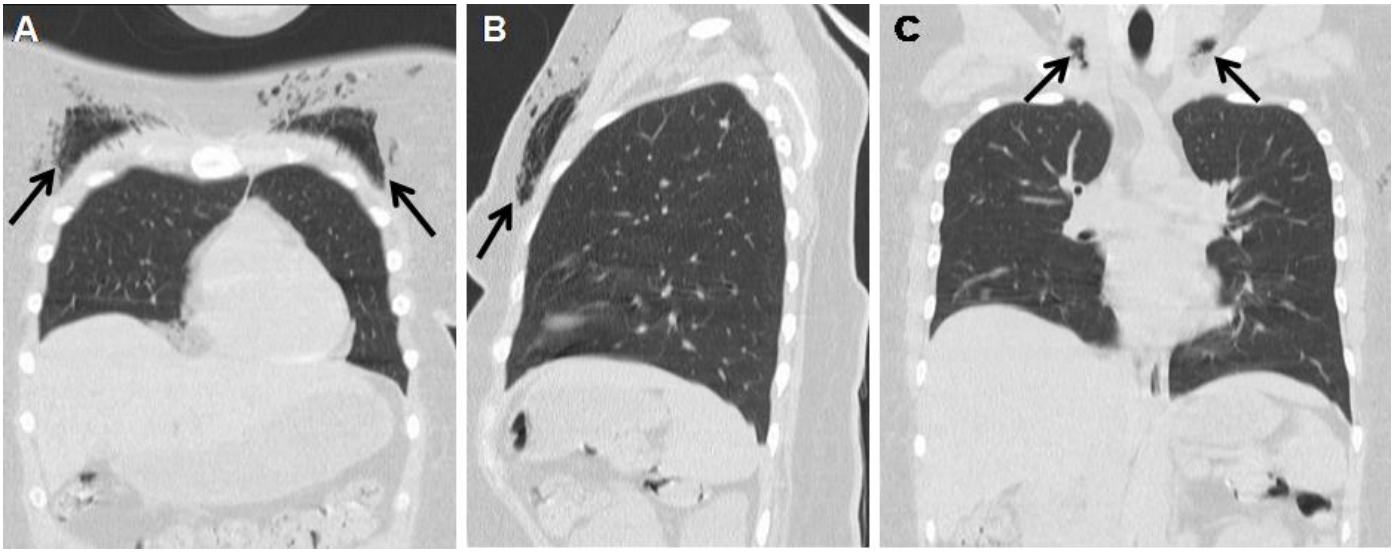

Figure 1: 32-year-old female with subcutaneous emphysema.

Findings: Coronal and sagittal reconstructions of non-enhanced CT of thorax demonstrate small foci of gas in neck and chest subcutaneous fat, compatible with subcutaneous emphysema (arrows).

Technique: Axial CT 135 Kvp, 107 MA 1.25 mm slice, non-enhanced.

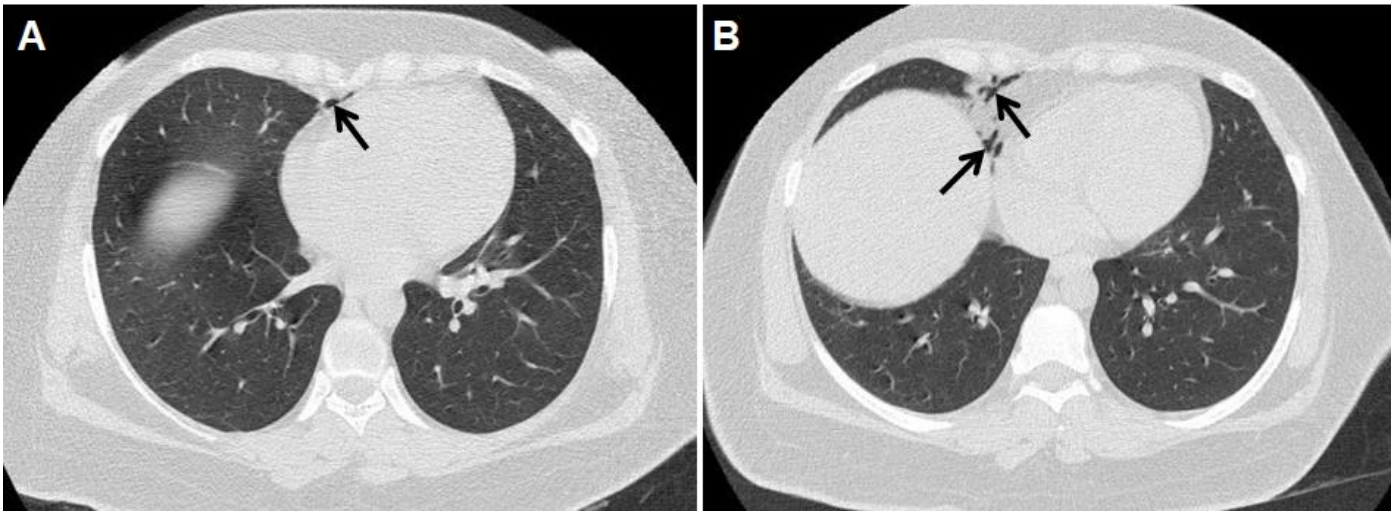

Figure 2: 32-year-old female with pneumomediastinum.

Findings: Axial non-enhanced CT of thorax demonstrates anterior small foci of gas in the anterior pericardial fat, suggesting pneumomediastinum (arrows).

Technique: Axial CT 135 Kvp, 107 MA 1.25 mm slice, non-enhanced.

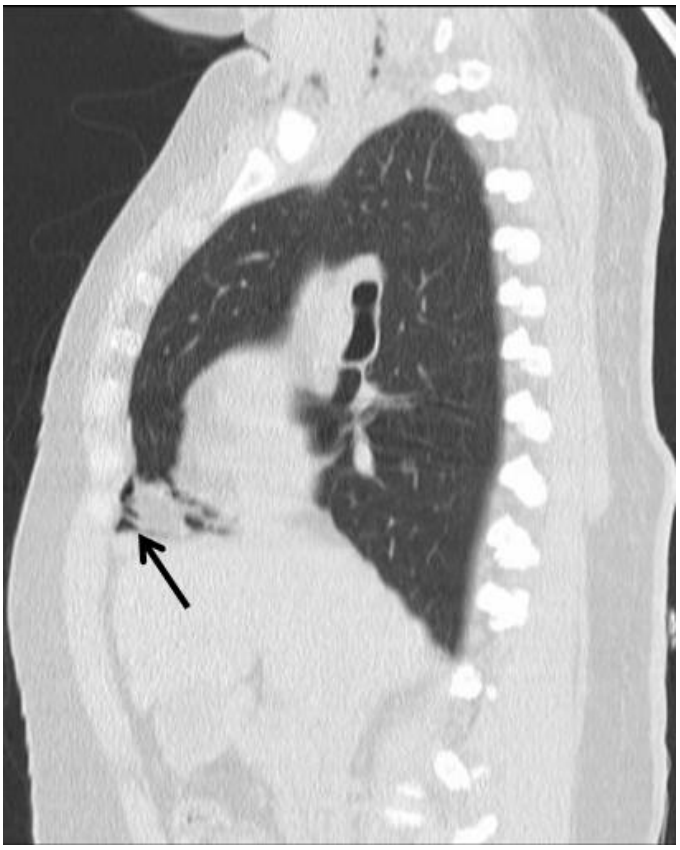

Figure 3 (left): 32-year-old female with pneumomediastinum.

Findings: Sagittal reconstruction of non-enhanced CT of thorax demonstrates small focus of gas in the anterior pericardial fat, suggesting pneumomediastinum (arrow).

Technique: Axial CT 135 Kvp, 107 MA 1.25 mm slice, non-enhanced.

Etiology	Unknown [5]
Precipitating factors	Coughing, emesis, intense physical exercise, labor, upper-airway infection, and diabetic ketoacidosis [8]
Incidence	1 per 7,000–12,000 hospital admissions [1]
Gender ratio	2.7 males:1 female [7]
Age predilection	20–30 years of age [5]
Risk factors	Athletic physical activity, drug use [7], asthma, and smoking
Treatment	Rest, analgesia, bronchodilator, and steroids [5]
Prognosis	Self-limited condition, usually benign [5]
Findings on imaging (chest X-ray or CT)	Collections of air delineating mediastinal structures and air bubbles. Subcutaneous emphysema is usually associated [7, 9, 10]

Table 1: Summary table of spontaneous pneumomediastinum.

Diagnoses	X-Ray	CT
Spontaneous pneumomediastinum	Lucent streaks surrounding mediastinal structures; Subcutaneous emphysema is usually found [7, 9, 10].	Gas surrounding mediastinal structures, usually seen i anterior mediastinum; Subcutaneous emphysema can be found [7, 9, 10].
Esophageal perforation (Boerhaave's syndrome)	Lucent streaks surrounding mediastinal structures; Subcutaneous emphysema can be found; Costophrenic opacity and pneumothorax can be associated [12, 14].	Gas surrounding mediastinal structures, usually seen i posterior mediastinum and under diaphragm; Pleural effusion; Pneumothorax; Paraesophageal abscess can be found [12, 14].
Pericarditis	Often normal; Enlarged cardiac area (water-bottle sign) can be found [15, 16].	Pericardial effusion; Pericardial thickening [15, 16].
Tension pneumothorax	Collapsed lung associated with a lucent area without vessels in pleural space [18].	Collapsed lung; Pneumothorax; Enlarged jugular veins can be seen [18].

Table 2: Differential diagnosis table for spontaneous pneumomediastinum.

ABBREVIATIONS

CT = Computed Tomography

KEYWORDS

Mediastinal Emphysema; Spontaneous Pneumomediastinum; Thoracic Disease; Computed Tomography; Mediastinal Disease