

Sudden onset of substernal chest pain in a college student at rest

Despite its name, spontaneous pneumomediastinum may be associated with a number of factors, including illicit drug use, that need to be ruled out with an appropriate history.

David F. Irvine, DHSc, RPA-C; Wilson Crone, MD, PhD

CASE

A healthy 19-year-old white male presented to the student health service complaining of substernal chest pain for 1 hour. He described the pain as “achy” and rated its severity as 5 on a scale of 0 to 10. The patient denied any radiation to the arms, shoulders, neck, or back. He stated that the pain came on suddenly while he was seated in a classroom and had been constant since it started. Onset was not precipitated by coughing, straining, or any other identifiable event. He noted that extending his neck or leaning forward exacerbated the pain. Nothing he did alleviated it. He denied palpitations, light-headedness, nausea, sweating, or weakness. The patient reported mild dyspnea while walking across campus to the health service, but he was not short of breath. He did not have a cough or cold, sputum production, wheezing, or other respiratory complaint. He denied recent vomiting, abdominal pain, diarrhea, or other GI symptoms.

On questioning, the patient reported no history of significant medical problems or surgeries. In fact, he said he had felt “entirely well” until the pain started. His family history was significant for hypertension in his father and uncles. There was no history of other cardiac or respiratory disease. The patient was a second-semester junior in good academic standing. As an on-campus emergency medical technician (EMT), he was well-known to the health service staff, who considered him to be reliable and responsible. He denied any use of recreational drugs, including cocaine, cannabis, and Ecstasy, but admitted to drinking beer on weekends when not on duty; he had last drunk beer 5 days prior to presentation.

On physical examination, he appeared to be in minimal distress. His vital signs were stable with a slight increase in heart rate (85 beats per minute). His skin was warm and dry and without cyanosis, pallor, or diaphoresis. There was no subcutaneous emphysema in the neck or chest. Lung sounds were clear and bilaterally equal. Cardiac examination revealed a loud precordial *crunch* coincident with systole but was otherwise unremarkable. The extremities were free of clubbing, cyanosis, or edema.

The patient was sent to the local hospital for a chest radiograph. Findings of linear streaks of gas in the mediastinum extending into the neck (see Figure 1) and periaortic air, also known as the “ring-around-the-artery” sign (see Figure 2, page 32), led to radiologic identification of a pneumomediastinum. The patient was then referred to the emergency department for a surgical consultation and subsequently admitted for treatment with supplemental oxygen, analgesics, and bed rest. Daily chest radiographs were used to follow the resolution of the pneumomediastinum. Six days later, he was discharged with a diagnosis of sponta-



FIGURE 1. Chest radiography shows air in the mediastinum.

neous pneumomediastinum (SPM), as no causative or correlative activity was identified, and he returned to school. He was restricted from athletics for 1 month. There was no recurrence of the pneumomediastinum during the next 2 years while the patient continued as an undergraduate student.

DISCUSSION

SPM refers to the presence of free air in the mediastinum of a patient without underlying lung disease. With an incidence of approximately 1 in 25,000 to 44,000 patients,^{1,3} SPM is an uncommon condition that has been described only occasionally in the medical literature over the past 30 years. Many of the published papers are case reports, as determined by searches of appropriate databases, eg, PubMed, Ovid, and MEDLINE. These case reports suggest that the term *spontaneous pneumomediastinum* can have various interpretations. While *spontaneous* implies an occurrence without a precipitating event, most of the 82 case reports reviewed identify some associated cause (33%), preexisting disease process leading to the SPM (26%), physiologic process leading to the SPM (23%), or SPM due to some medical procedure or treatment (4%). Only 15% of the cases identified could be considered truly spontaneous.

Specific etiologies of nonspontaneous pneumomediastinum identified in the literature can be classified as related to sports, drugs, or air pressure changes. Sports-related causes include weight lifting, football, swimming, and diving.^{4,7} Older literature implicated marijuana, heroin, or cocaine use.^{8,9} More recently, Ecstasy (3,4-methylenedioxymethamphetamine, or MDMA¹⁰⁻¹²) has been implicated in SPM, more from respiratory efforts or Valsalva maneuvers involved in use of that drug than because of direct pharmacologic actions. Overall, most disease processes associated with SPMs have been respiratory in nature, including asthma, bronchial tumor, and pulmonary fibrosis.^{2,3,13-15} Most physiologic processes reported to have led to SPM are related to increased intrathoracic pressure, as in the aforementioned Valsalva maneuvers. The physiologic processes noted include events surrounding pregnancy, childbirth, and delivery,¹⁶ vomiting with anorexia nervosa,¹⁷ and hyperemesis gravi-

darum,¹⁸ although these did not apply in this case. Because of our patient's background as an EMT, he was able to provide information that led to the elimination of any of the proposed etiologies.

Diagnosis Reviews based on case series demonstrate that most patients with SPM are young males who present with chest pain or dyspnea as their first or second complaint.^{1,3,19-21} Chest pain is described as substernal, radiating to the back or neck, and increased by deep inspiration or swallowing. Dysphagia and neck pain are common as well. Physical

“Further evaluation may be needed to rule out tension pneumothorax, ruptured laryngocele, or foreign-body obstruction.”

examination often reveals normal vital signs; occasionally, the examination is entirely normal. Specific findings may include palpable subcutaneous emphysema (with a “bubble-wrap” texture) in the neck, decreased cardiac dullness to percussion, and mediastinal crepitation (crunch) with systole (Hamman's sign).^{1,3,19-21} Most authorities suggest that radiographic findings commonly include air in the mediastinum and subcutaneous air in the soft tissues of the neck.^{1,3,19-21} These findings are demonstrated on radiographs by linear streaks of gas in the mediastinum extending into the neck, periaortic air, air enveloping the right pulmonary artery, or a continuous diaphragm sign with air interspersed between the pericardium and the diaphragm. Such radiographic patterns are consistent with the pathophysiology of SPM, in that free air would tend to track along the interstitial tissue surrounding the bronchi and blood vessels before possible expansion into the mediastinal spaces.

In some cases, further evaluation with endoscopy and CT may be indicated to evaluate underlying causes of SPM.^{1,3,19,20} Specifically, tension pneumothorax, ruptured laryngocele, and

TEACHING POINTS

- Despite what the name implies, only 15% of spontaneous pneumomediastinum (SPM) cases are reported to be isolated occurrences. According to a literature review, 33% of cases have some associated cause, 26% have a preexisting disease process leading to the SPM, 23% have a physiologic process leading to the SPM, and 4% are due to some medical procedure or treatment.
- Most patients with SPM are young males who complain of substernal chest pain that radiates to the back or neck and is exacerbated by inspiration. Dysphagia and neck pain are also common.
- Radiographic findings include linear streaks of gas in the mediastinum extending into the neck, periaortic air, air enveloping the right pulmonary artery, or a continuous diaphragm sign with air interspersed between the pericardium and the diaphragm.
- When evaluating suspected SPM, rule out tension pneumothorax, ruptured laryngocele, foreign-body obstruction, pulmonary embolus, panic disorder, exercise-induced bronchospasm, cervical or mediastinal tumors, drug abuse, carotid thrombosis, cervical radiculopathy, and esophageal strictures.
- Most patients with SPM require no active intervention. Supplemental oxygen, reassurance, and analgesics may be all that is necessary. In rare cases, needle decompression of a tension SPM may be required. Progression to fatal pneumomediastinum has been reported, albeit in a patient with dermatomyositis.

CASE REPORT | Pneumomediastinum

foreign-body obstruction need to be ruled out when diagnosing SPM.³ Other conditions to consider include pulmonary embolus, panic disorder, exercise-induced bronchospasm, cervical or mediastinal tumors, drug abuse, carotid thrombosis, cervical radiculopathy, and esophageal strictures.¹

Management and prognosis Expectant care with supplemental oxygen, reassurance, and analgesics may be all that is required for patients with SPM.^{1,3,19,20} Typically these patients have been followed with serial radiographs, but the value of repeat films has been questioned because of the condition's benign course.³ Use of antibiotics has been reported but challenged because infection has not been a common sequela of SPM.¹ In rare cases, needle decompression of a tension SPM may be required;²¹ however, most patients do not require any active intervention. While SPM is usually benign and self-limited, progression to fatal pneumomediastinum has been reported, albeit in a patient with dermatomyositis.²² In one case series of 25 patients, 2-year follow-up identified four cases of spontaneous pneumothorax but only one recurrent SPM.¹

Conclusion The use of the word *spontaneous* in the description of SPM has come to include many conditions that do not meet its strict interpretation. There remain a significant number of cases, such as the one presented here, for which precipitating events cannot be or were not identified. These can be classified as *idiopathic spontaneous pneumomediastinum*. This may be the result of poor history-taking, lack of patient

“While SPM is usually benign, progression to fatal disease has been reported, albeit in a patient with dermatomyositis.”

candor (specifically where illicit drugs are involved), or mechanisms yet to be identified. Despite the fact that patients with SPM typically do well, clinicians need to be aware of the life-threatening conditions that are included in the differential diagnosis and must be ruled out, a correlation with illicit drug abuse, and the risks of unnecessary procedures and treatments. **JAAPA**

David Irvine is program director of the Albany Medical College Physician Assistant Program, Albany, New York. **Wilson Crone** is a basic science instructor, also in the Albany Medical College Physician Assistant Program. The authors have indicated no relationships to disclose relating to the content of this article.

REFERENCES

1. Abolnik I, Lossos IS, Breuer R. Spontaneous pneumomediastinum. A report of 25 cases. *Chest*. 1991;100(1):93-95.
2. Newcomb AE, Clarke CP. Spontaneous pneumomediastinum: a benign curiosity or a significant problem? *Chest*. 2005;128(5):3298-3302.
3. Macia I, Moya J, Ramos R, et al. Spontaneous pneumomediastinum: 41 cases. *Eur J Cardiothorac Surg*. 2007;31(6):1110-1114.
4. Asplund CA, Howard TM, O'Connor FG. Spontaneous pneumomediastinum in a weightlifter. *Curr Sports Med Rep*. 2003;2(2):63-64.
5. Kahn DA. An adolescent football player with chest pain. *Clin Pediatr (Phila)*. 2003;42(5):471, discussion 471-473.
6. Ferro RT, McKeag DB. Neck pain and dyspnea in a swimmer: spontaneous pneumomediastinum presentation and return-to-play considerations. *Phys Sportsmed*. 1999;27(10):67-71.
7. Albaugh G, Kann B, Whalen TV. Spontaneous pneumomediastinum in a shallow-water-diving child. *Pediatr Emerg Care*. 2001;17(4):262-263.
8. Mattox KL. Pneumomediastinum in heroin and marijuana users. *JACEP*. 1976;5(1):26-28.
9. Barbera Mir JA, Vallejo Galvete J, Velo Plaza M, et al. Spontaneous pneumomediastinum after cocaine inhalation. *Respiration*. 1986;50(3):230-232.
10. Ryan J, Banerjee A, Bong A. Pneumomediastinum in association with MDMA ingestion. *J Emerg Med*. 2001;20(3):305-306.
11. Badaoui R, El Kettani C, Fikri M, et al. Spontaneous cervical and mediastinal air emphysema after ecstasy abuse. *Anesth Analg*. 2002;95(4):1123.
12. Marasco SF, Lim HK. Ecstasy-associated pneumomediastinum. *Ann R Coll Surg Engl*. 2007;89(4):389-393.
13. Momin AU, Chung DA, John LC. Childhood asthma predisposes to spontaneous pneumomediastinum. *Emerg Med J*. 2004;21(5):630-631.
14. Baram D. Endobronchial tumor presenting with recurrent pneumomediastinum: case report and review of the literature. *Journal of Bronchology and Interventional Pulmonology*. 2003;10(3):189-191.
15. O'Connor I, Thomas GO. Spontaneous pneumomediastinum in a patient with fibrosing alveolitis. *Respir Med*. 1993;87(4):313-314.
16. Sutherland FW, Ho SY, Campanella C. Pneumomediastinum during spontaneous vaginal delivery. *Ann Thorac Surg*. 2002;73(1):314-315.
17. Sundararaghavan S, Pitts TY, Suarez WA, Johnstone C. Chest pain among adolescents with anorexia nervosa. *Pediatr Emerg Care*. 2005;21(9):603-605.
18. Yamamoto T, Suzuki Y, Kojima K, et al. Pneumomediastinum secondary to hyperemesis gravidarum during early pregnancy. *Acta Obstet Gynecol Scand*. 2001;80(12):1143-1145.
19. Koullias GJ, Korkolis DP, Wang XJ, Hammond GL. Current assessment and management of spontaneous pneumomediastinum: experience in 24 adult patients. *Eur J Cardiothorac Surg*. 2004;25(5):852-855.
20. Mondello B, Pavia R, Ruggeri P, et al. Spontaneous pneumomediastinum: experience in 18 adult patients. *Lung*. 2007;185(1):9-14.
21. Chalumeau M, Le Clainche L, Sayeg N, et al. Spontaneous pneumomediastinum in children. *Pediatr Pulmonol*. 2001;31(1):67-75.
22. Matsuda Y, Tomii M, Kashiwazaki S. Fatal pneumomediastinum in dermatomyositis without creatine kinase elevation. *Intern Med*. 1993;32(8):643-647.

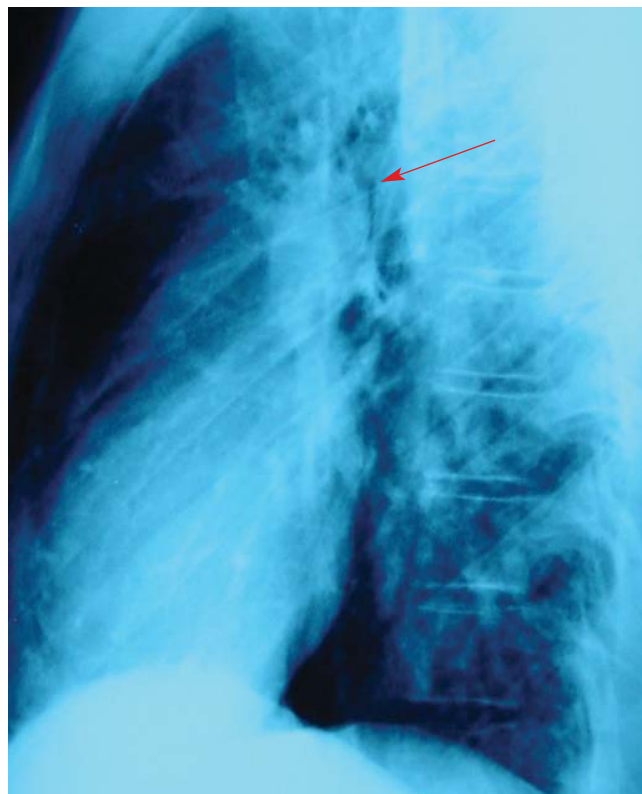


FIGURE 2. Chest radiograph (lateral view) reveals an incomplete ring-around-the-artery sign.