Spontaneous Pneumomediastinum*  
A Benign Curiosity or a Significant Problem?

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**Objective:** To identify the significance of spontaneous pneumomediastinum (SPM) and to optimize its management.

**Methods:** A retrospective analysis was undertaken of all patients presenting with SPM over a 5-year period. Eighteen patients were identified, and information on their presentations, initial diagnoses, comorbidities, investigations, clinical courses, length of hospital stays, and outcomes were collated.

**Setting:** The emergency department referrals of two major Melbourne teaching hospitals.

**Results:** SPM is an uncommon condition presenting in approximately 1 in 30,000 emergency department referrals. The typical patient identified from this study is a young man who is likely to have a history of asthma, and who is also likely to smoke or to use illicit drugs. The most common presentation is nonspecific pleuritic chest pain with dyspnea. Complications are rare, and the clinical course benign, but the possibility of a ruptured viscus or an initial misdiagnosis often leads to a great number of investigations. A proposed algorithm of management is given. Other serious and potentially life-threatening conditions, such as Boerhaave syndrome need to be excluded.

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**Key words:** asthma; lung; marijuana; mediastinum

**Abbreviation:** SPM = spontaneous pneumomediastinum

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Pneumomediastinum is defined as the presence of air within the mediastinum and may be the result of a catastrophic event, such as blunt or penetrating trauma, gas producing organisms, or esophageal rupture after vomiting. Spontaneous pneumomediastinum (SPM) is an uncommon but mainly benign finding in a small group of younger patients who present with no history of an obvious precipitating event. The purpose of this study was to assess the incidence, presentation, and investigations required to accurately diagnose this uncommon clinical entity, and to propose a single plan of management.

**Materials and Methods**

Between July 1999 and October 2004, all patients who were admitted to the Austin and Box Hill Hospitals with a diagnosis of SPM were reviewed. Their files were assessed retrospectively, and their demographic details, precipitating factors, comorbidities, symptoms, signs, treatments, and outcomes were collated.

**Results**

Eighteen patients were identified from a review of the hospital records. There were 14 men and 4 women, and the patients had a median age of 20 years (age range, 11 to 58 years).

**Presentation**

The most common presenting complaint was chest pain, occurring in 16 patients (Table 1). Dyspnea was the next most common complaint (12 patients). Other presenting complaints were dysphagia, neck pain and swelling, and hoarse voice. Thirteen of the 18 patients had two symptoms related to their admission to the hospital, while 2 patients had three or more symptoms. Other associated problems were mild asthma in seven patients, history of smoking in six patients, illicit drug use in four patients, and interstitial lung disease in one patient. The latter patient was an older female, who normally received therapy with oral corticosteroids for her lung disease and had experienced no specific precipitating event prior to the onset of her symptoms. Five patients reported no comorbidities.
The patients reported precipitating events in only half of the presentations. Coughing was thought to have initiated the event in three patients, retching was noted by two patients, one patient fell off his bicycle, and three patients were involved in noncontact sports prior to becoming symptomatic (running, two patients; trampolining, one patient). The initial diagnosis was correctly made in 14 of 18 patients. For the remaining patients, the diagnosis was thought to represent viscus rupture in three patients and acute pericarditis in one patient.

**Physical Findings**

The most common physical finding on presentation was subcutaneous emphysema. This was present only in the neck in 12 patients, and it extended down over the chest in two patients. Hamman sign, which is a crunching sound in time with the heartbeat, was noted in four patients, and it was the only abnormality on physical examination for one of those patients.

**Investigations**

All of the patients had undergone at least one radiologic investigation, while 11 of the patients had undergone two investigations, and 5 patients had undergone three investigations. Table 2 outlines the investigations ordered for these patients, while Figures 1 and 2 show representative chest radiographs and CT scans.

**Table 1—Symptoms Related to Presentation***

<table>
<thead>
<tr>
<th>Symptom</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest pain</td>
<td>16</td>
<td>89</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>12</td>
<td>67</td>
</tr>
<tr>
<td>Dysphagia</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Neck pain</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Neck swelling</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Hoarse voice</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

*Some patients had more than one presenting complaint.

**Outcomes**

All patients were admitted to the hospital and observed for a period of time, while one female patient was admitted to the ICU. All patients survived and were discharged from the hospital after a median time of 2 days (range, up to 14 days). Most patients were seen early after their hospital discharge with normal findings on a chest radiograph, and then were discharged back to the primary care physician. All patients were well at the time of the review. For some of the patients, the primary care physician was the only point of follow-up. There is no record of any of these patients having a recurrence of their SPM.

Only one patient had a complication related to their SPM. This was a young man who had reportedly been involved in a heated argument the night of his hospital admission. He was a smoker and had no history of interstitial lung disease. He had presented with a history of chest pain, and his investigation findings were normal. He required an intercostal catheter for a secondary pneumothorax. No patient had a perforated viscus.

**Discussion**

The first physician to describe SPM and some of the predisposing factors was Laennec in the early 19th century,1 and the first report of a series of patients with SPM was in 1939 by Hamman.3 The pathognomonic sign of SPM (Hamman’s sign) bears
his name and is characterized by a crunching or bubbling sound that is synchronous with the heart-beat.

SPM has been described predominantly in young adult men, and its incidence has been reported as occurring in 1 in 8004 to 1 in 42,000 hospital admissions. The incidence appears to be increasing in more recent reports, but this may reflect greater physician awareness and better access to quality investigations. In our series, we were able to calculate the incidence based on annual activity data from the emergency departments at the Austin Hospital (G. Braitberg, MD; personal communication; 2005) and the Box Hill Hospital (A. MacLean, MD; personal communication; 2005). We have identified an incidence of 1 in 29,670 between the two institutions, and this may reflect the older population that is treated in this area.

Macklin and Macklin initially described the pathophysiology of this condition in 1944 based on the results of animal experiments. The underlying factor was terminal alveolar rupture into the lung interstitium secondary to increased alveolar pressure or overdistension or decreased perivascular interstitial pressure, and the dissection of that gas into the hilum and subsequently the mediastinum along a pressure gradient. From there, the gas follows the fascial planes, often into the tissues of the neck.

In a review of the literature, SPM had been associated with activities that result in the Valsalva maneuver such as childbirth, forceful straining during exercise, straining at stool, coughing, sneezing, retching, or vomiting. There have also been reports of significant barotrauma resulting in subcutaneous emphysema and SPM that followed pulmonary function testing and inflation of party balloons. A history of asthma has been reported as a factor in the development of SPM in up to 50% of cases, and in this series we had 39% of patients with a recent or remote history of asthma. Only one of our patients had experienced a severe attack that was thought to have precipitated the SPM. Other medical conditions may predispose the patient to the development of SPM. One example of this is interstitial lung disease and treatment with corticosteroids, as was noted in one of our patients. It is somewhat controversial to consider this to be a spontaneous event in this situation, but there was no precipitating event for the development of the condition. It has also been noted previously that extraalveolar air accumulations are relatively common in patients with interstitial lung disease because of the negative interstitial pressures resulting from reduced lung compliance.

This patient is not typical of those with this condition, but we thought that she should be included in this analysis to highlight the point that interstitial lung disease can be associated with SPM.

SPM has also been seen in illicit drug users, specifically in those who had used inhalational drugs, but more recently it has been seen in those using speed (methylenedioxyamphetamine) or ecstasy (methylenedioxy-metamphetamine). In those patients using inhalational drugs, the etiology of this is thought to be that of prolonged forceful breath holding, while in those who use ecstasy or speed it is thought that the high levels of physical exertion and decreased interstitial pressure result in the pressure gradient needed for rupture of the alveoli. Currently, there appears to be no evidence to support a direct pharmacologic effect. Koullias et al thought that there would be an increase in the incidence as a direct result of higher levels of recreational drug use in younger individuals.

In our series, the most common presentation was chest pain and associated shortness of breath. This followed the general pattern observed by other authors. The pain is typically retrosternal, which may radiate to the back or into the neck, and it is usually pleuritic in nature. The combination of pain and shortness of breath often cause anxiety in
these patients. Although two of the early patients of Hamman were able to describe and identify their abnormal cardiac sound, which featured highly in his initial diagnoses, none of our patients could detect any abnormality of their heartbeat, and, indeed, only four of these patients had this identified as part of their physical examination findings. The most common finding on physical examination in this group of patients was subcutaneous emphysema of the neck. The other feature of the examination of these patients was general wellness, and their vital signs were mostly within the normal range. This reflects the fact that this condition is not due to any other, more serious abnormalities.

The absence of more serious abnormalities, as described previously (ie, trauma, gas-forming organism, and perforated viscus), need to be excluded in these patients, especially those who have a history of vomiting or retching. Boerhaave syndrome must be considered in any person who has a history of vomiting followed by chest pain with dyspnea, or possibly cardiovascular collapse. This is usually a condition that leads to rapid clinical deterioration, but not always. In our series, the most common investigation performed was a plain chest radiograph, and this was the only investigation performed in seven of our patients. Kaneki et al showed in their series that a radiograph alone poorly detected 30% of cases of SPM, and they said a radiograph should be used in conjunction with a CT scan of the chest. We think that if the chest radiograph is diagnostic of pneumomediastinum and the patient’s history does not indicate a potentially perforated intrathoracic viscus, then no further investigations are required. If there is a suspicion of pneumomediastinum and the chest radiograph finding is not diagnostic, then a CT scan of the chest with IV contrast should be performed. If there is a suspicion of Boerhaave syndrome on the basis of the patient’s history, physical examination or investigations, then a contrast-enhanced swallow is mandatory.

As reported previously and identified in this study, SPM usually follows a benign and self-limiting course, and the usual treatment required is bed rest, oxygen therapy, reassurance, and analgesics. It should be remembered, however, that potentially life-threatening complications might arise. These were defined from the research of Macklin and Macklin in animals and include the following conditions: (1) tension pneumomediastinum; (2) single or bilateral simple pneumothorax or tension pneumothorax; and (3) increased pressure in the pulmonary interstitium, making respiration difficult. Some authors think that the development of these complications may be a direct result of being unable to decompress the pressure within the mediastinum with potential subsequent rupture of and escape of gas into the pleural space.

All of these patients should be observed for a period of time in a hospital setting to exclude the development of complications of SPM, as described. Antibiotics are generally not needed except when there is suspicion of perforation and the results of a contrast-enhanced swallow procedure are being awaited. A complication (pneumothorax) developed in only 1 of our 18 patients during their hospital admission.

At follow-up, all of these patients were well with complete resolution of their SPM. There was no report of the recurrence of SPM in any of these patients, and there is only one report in the literature of recurrences related to this disease entity.

**Conclusions**

SPM is a rare condition that is often seen in the primary care setting in the first instance. In our series, we have shown SPM to have an incidence of approximately 1 in 30,000 emergency department presentations. This diagnosis should be considered in...
younger people who present with pleuritic chest pain and look well otherwise, with normal vital signs. This especially applies to those with a recent history of the ingestion of ecstasy or speed.

These patients should undergo testing, as outlined in Figure 3, and preferably should be observed for the development of complications that are related to SPM as an inpatient for at least 24 h. These patients should also be monitored to exclude the presence of a ruptured viscus. In most of these patients, it appears that the pneumomediastinum resolves over a period of 1 week, and they rarely experience any sequelae to this problem.

REFERENCES

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