Spontaneous mediastinal emphysema

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Abstract

Objective: Spontaneous mediastinal emphysema is uncommon. Its cause has not been determined precisely, but the entity is usually associated with suddenly raised alveolar pressure. Methods: Between 1980 and 2001, 114 patients with mediastinal emphysema of various causes were hospitalized in the Wolfson Medical Center. In 22 of these patients (19.3\%) the emphysema occurred without an obvious preceding event and was classified as spontaneous. The commonest symptoms and signs were chest pain, dyspnea and subcutaneous emphysema. All patients were kept under observation. Contrast esophagogram was performed in two patients who vomited. Pleural drains were inserted in six patients who had concomitant pneumothorax. Results: All patients recovered and were followed for at least one year. There were no complications and no recurrences. Conclusions: Spontaneous mediastinal emphysema is usually a benign condition, which can be treated expectantly. The patients should be observed for 24 h. Recurrences are rare.

Keywords: Mediastinum; Emphysema; Mediastinal emphysema; Pneumomediastinum

1. Introduction

Mediastinal emphysema or pneumomediastinum is an entity in which free air surrounds mediastinal structures. The majority of instances are caused by trauma—accidental, assault or iatrogenic; however, some occur without an apparent cause and are referred to as ‘spontaneous’. In fact, they are not truly spontaneous, but are usually caused by suddenly raised intraalveolar pressure due to cough, sneezing, vomiting, labor or Valsalva maneuver [1,2]. Some have been associated with use of cocaine [3], marijuana smoking [4], pulmonary function testing [5], and asthma [6]. Increased pulmonary alveolar pressure, pulmonary capillary hypotension and alveolar wall defects are often present [7]. Contributing factors include pneumothorax and perforation of the trachea, bronchus or esophagus into the mediastinum.

2. Patients and methods

Between 1980 and 2001, 114 patients with mediastinal emphysema were hospitalized on the Thoracic Surgery Service of the Wolfson Medical Center. Free air in the mediastinum was always confirmed by roentgenograms or by computerized tomographic scan (CT). Patients with subcutaneous emphysema and symptoms of mediastinal involvement, such as retrosternal pain or dyspnea but not confirmed radiologically, were not included. There were 34 patients with history of preceding external trauma (motor vehicle accident, fall, or assault), 19 instances followed thoracic operations, 36 occurred after invasive medical or surgical procedures, and three resulted from perforation of the esophagus. In 22 patients (19.3\%), there was no obvious preceding event. These 22 patients form the basis of this report. There were 12 male and 10 female patients, their age ranging from 15 to 37 years. Their symptoms and signs are summarized in Table 1. Eight patients presented with history of coughing just prior to the onset of symptoms, seven, with history of shouting, three patients were in labor, two vomited, and in two patients no preceding physical strain was noted. The emphysema was associated with pneumothorax in six patients (left five, bilateral one), pneumopericardium in three and leucocytosis in five (Table 1).

Contrast esophagograms were performed in the two patients who vomited. Both showed normal findings. Pleural drains were inserted in the six patients with...
pneumothorax. The drains were attached to underwater seal without suction, and were left, until complete lung expansion occurred. The status of mediastinal emphysema was followed by postero-anterior radiograms in all patients and by CT scans in four.

3. Results

All patients were kept under observation. In all patients with pneumothorax complete lung expansion occurred within 1–5 days (mean 2.8), at which time the pleural drains were removed. Complete resolution of the pneumomediastinum occurred in all patients within three to seven days. Hospitalization lasted from one to six days (mean 3.5). Follow up was maintained for 1 year in all patients. No recurrences were noted.

3.1. Illustrative case

A 19-year-old girl was admitted because of retrosternal pain and dyspnea that were noted immediately after ‘wild shouting’ at a party. Over the next several hours, the pain extended to the neck and increased during swallowing. Physical examination disclosed a well-appearing young woman in slight distress. The vital signs were normal. On palpation of the chest and neck, crepitation consistent with subcutaneous emphysema was felt. There were no other abnormal findings. Roentgenograms of the chest and neck showed mediastinal emphysema, with air extending to the tissues of the neck (Figs. 1 and 2). Over the next 3 days, her symptoms subsided, the subcutaneous emphysema absorbed and the chest roentgenogram returned to normal. After 1 year, she was asymptomatic.

3.2. Comment

This case illustrates how a minor precipitating factor, such as shouting, can bring about pneumomediastinum.

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Table 1
Symptoms, signs and associated findings

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest pain</td>
<td>18</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>10</td>
</tr>
<tr>
<td>Cough</td>
<td>8</td>
</tr>
<tr>
<td>Dysphagia</td>
<td>8</td>
</tr>
<tr>
<td>Subcutaneous emphysema</td>
<td>12</td>
</tr>
<tr>
<td>Fever</td>
<td>7</td>
</tr>
<tr>
<td>Hamman’s sign</td>
<td>5</td>
</tr>
<tr>
<td>Pulsus paradoxus</td>
<td>2</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>6</td>
</tr>
<tr>
<td>Left</td>
<td>5</td>
</tr>
<tr>
<td>Bilateral</td>
<td>1</td>
</tr>
<tr>
<td>Pneumopericardium</td>
<td>3</td>
</tr>
<tr>
<td>Leucocytosis</td>
<td>5</td>
</tr>
</tbody>
</table>

Fig. 1. ‘Spontaneous’ mediastinal emphysema due to shouting. Air is present in the mediastinum. Note linear image of pneumomediastinum along the left contour of the heart.

Fig. 2. Large amount of air in the tissues of the neck. Air separates the esophagus from the spine.
The symptoms can be severe, but the condition is benign and self-limited.

4. Discussion

Spontaneous pneumomediastinum is defined as non-traumatic presence of free air in the mediastinum in a patient with no known underlying disease. It has long been recognized as a self-limited benign condition in young individuals. According to Munsell, it was first recognized by Louise Bourgeois, midwife to the queen of France, who recorded in Observations in 1617: “I saw that she stopped crying out and I implored her not to stop for fear that her neck might swell.” [7,8]. This entity develops as a result of the increase in intrabronchial and intraalveolar pressure with a vigorous expiration against closed glottis (the Valsalva maneuver). If a large enough pressure gradient is generated, alveolar rupture occurs, allowing air to penetrate peribronchial and perivascular spaces and to reach the mediastinum (the so-called Macklin effect) [9–11].

The most frequent symptoms and signs are pain in the chest and neck, exertional dyspnea, subcutaneous emphysema, hypotension, dysphagia and cough. Although rare, cyanosis may also be present. Hamman described the ‘mediastinal crunch’ sign, consisting of crunch-like sound over the left hemithorax anteriorly. It is generally reported in about 50% of patients [12,13].

The diagnosis is confirmed by chest radiography, which shows streaky gas densities along the fascial planes of the mediastinum. If routine lateral roentgenograms are added, nearly 100% accuracy is achieved. The importance of radiographic diagnosis was stressed by Yellin and colleagues who proposed that chest radiography should be performed routinely on every young patient seen in the emergency room for unexplained chest pain or shortness of breath [14]. If the findings are not sufficiently clear, other examinations may be necessary, such as CT scan and esophagogram. However, these patients are often overevaluated. Bronchoscopy has little role to play in the clinical workup, and there is no point to insert chest tubes when no pneumothorax is present. Contrast esophagogram was performed in two of our patients, who vomited, to rule out perforation of the esophagus. This is in contrast to Gerazounis and associates [2] who included an esophagogram in the initial investigation of all their patients.

After specific causes of mediastinal emphysema have been excluded, primary spontaneous pneumomediastinum can usually be treated expectantly. However, serious complications are possible. In tension pneumomediastinum increased mediastinal pressure develops, which can be fatal [15]. Macklin and Macklin described this extreme variant as ‘malignant pneumomediastinum’ [9]. It arises from interference of air in the lung and mediastinum, causing compression of pulmonary and mediastinal vessels and interference with respiration by the splinting action of air in the interstitial tissues of the lung. It is characterized by dyspnea, cyanosis, engorged veins in the neck, rapid low-volume pulse and hypotension. It may mimic cardiac tamponade, and fatal cases have been reported [16,17]. For such life-threatening mediastinal and subcutaneous emphysema O’Neill and associates suggested ventilation with 100% oxygen [18]. However, this may not suffice. If not relieved promptly, this condition leads to pulmonary edema and circulatory failure. Attempts at treatment of malignant pneumomediastinum must concentrate at cessation of high pressure in the alveoli [15]. This can be achieved by urgent evacuation of air from the mediastinum by multiple subcutaneous aspirations or incisions into the subcutaneous tissues where the air has accumulated. Cervical mediastinotomy may be necessary if aspiration of air from the mediastinum has not sufficed. For malignant pneumomediastinum in neonates Moore and associates suggested tube drainage of the mediastinum through a subxiphoid incision. The dissection is carried out bluntly along the entire length of the sternum, thereby exposing the anterior mediastinum and the pericardium. Care must be taken to avoid perforation of the pleura. This technique was used in five patients, four of whom survived [19]. For the release of air under tension, various other incisions were also suggested, including transverse suprasternal with or without full sternotomy [17], infraclavicular [16], and tracheostomy [13].

Prognosis of mediastinal emphysema depends on the amount of air in the mediastinum and the etiology. Most patients with malignant pneumomediastinum require immediate decompression to save life. However, in the spontaneous cases this phenomenon is rare, and the outcome is usually good.

Hospitalization is recommended in patients with coexisting pneumothorax and when there is reasonable suspicion of esophageal or airway perforation. Other patients should be kept under observation in the Emergency Department for 24 h.

Recurrences of pneumomediastinum have been reported in association with vomiting [20,21], and with diabetic ketoacidosis [22]. Abolnik and colleagues found one recurrence among 23 patients [23]. In 1945, Hamman attributed the recurrences to a congenital weakness of the alveolar wall [24], but this has not been substantiated.

In conclusion, spontaneous mediastinal emphysema is usually a benign condition, which can be treated expectantly. Recurrences are rare.

References