Diagnosis and prognosis of traumatic pulmonary pseudocysts:
a review of 12 cases

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Abstract

Background: Traumatic pulmonary pseudocysts or post-traumatic pneumatoceles are a relatively rare-encountered condition occurring after trauma and an even rarer talked about subject. Most resolve within a few weeks, but if complicated by hematoma, may persist for months. This study intends to evaluate the resolution times of traumatic pulmonary pseudocysts and their clinical significance.

Methods: We report a case analysis of 12 cases from Hanyang University Guri Hospital dating from July 1997 through October 2004.

Results: The overall mean time for complete resolution was 85.6 days. The mean time for resolution for the uncomplicated traumatic pulmonary pseudocysts was 25.3 days (n = 6) and the mean time for resolution for the complicated (blood filled) traumatic pulmonary pseudocysts was 145.8 days (n = 6). When resolution times were compared according to size, those less than 2 cm showed a mean resolution time of 23.6 days (n = 5) and those greater than or equal to 2 cm showed a mean resolution time of 129.9 days (n = 7).

Conclusions: Comparisons between completely blood-filled pseudocysts and uncomplicated pseudocysts have shown statistically significant differences in resolution times. Statistical significance has also been found between pseudocysts of sizes less than 2 cm and those greater than or equal to 2 cm. Conservative treatment is generally the rule; close follow-up and symptomatic treatment are necessary.

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1. Introduction

Traumatic pulmonary pseudocysts have been described in the literature as traumatic pneumatoceles, traumatic lung cysts, and traumatic pulmonary pseudocysts. We also concur with the suggested ideal terminology, ‘traumatic pulmonary pseudocysts,’ because by definition, a cyst is a fully epithelial-lined cavity and should not be confused with traumatic cavities [1]. Traumatic pulmonary pseudocysts are relatively rare; Santos and Mahendra in 1978 reviewed 48 cases and since then 37 other cases have been reported in the English literature [1–12]. To the best of our knowledge there have been only 2 other 10 or greater than 10 case studies in the literature [10,12]. Our study involves a case analysis of 12 such original cases.

This study aims to evaluate and compare resolution times of traumatic pulmonary pseudocysts as a simple pseudocyst and as those complicated by blood-filled cavities, to evaluate whether size is a factor, and to evaluate their clinical significance.

2. Patients and methods

In this study, a total of 12 patients diagnosed with traumatic pulmonary pseudocysts from July 1997 through October 2004 at Hanyang University Guri Hospital were reviewed. The mechanism for all 12 patients was blunt injury. Cases with penetrating trauma and those caused by artificial ventilation (barotraumas) were excluded from this study. Among these patients, seven patients were retrospectively reviewed and five patients were prospectively reviewed (Table 1). In the patients that were prospectively reviewed, high-resolution computer scans were performed at approximately 2 weeks, 1 month, 3 months, 6 months, and thereafter, at 3-month intervals after the traumatic incident, depending upon whether complete resolution or only remnant scarring was visible on computer tomographic scans. Most of the cases were clear-cut, either completely blood-filled cavities or no blood-filled cavities (Figs. 1–5).
The cases that were blood-filled, but less than one-third of the entire cavity were placed into the uncomplicated group and the cases that had greater than or equal to one-third filled cavities were placed into the complicated group. The filled cavities were initially identified by simple chest X-rays and then later confirmed by chest computer tomographic scans, which were not always done at the exact indicated times. Statistical analyses were done by two-tailed independent \( t \)-test and Mann–Whitney \( U \)-test using software by SPSS (version 12.0). Probability values of 0.05 or less were considered statistically significant.

### 3. Results

The male to female ratio of patients with traumatic pulmonary pseudocysts was 11:1 and the mean age of the patients was 17.17 years with 75% of the patients being under 30 years. Three of the patients were smokers. The modes of injury included traffic accident in nine patients, fall down in two patients, and battery in one patient. The most common symptoms of traumatic pulmonary pseudocysts at initial presentation include chest pain in 10 patients (83.3%), dyspnea in 8 patients (66.7%), and hemoptysis in 4 patients (33.3%). Other symptoms at initial presentation include mental change in two patients (17%) and irritability in one patient (8%). In all of our patients, except one patient (Case #4), the traumatic pulmonary pseudocysts were discovered on the day of the blunt trauma incident at initial presentation. All of our patients had conditions such as traumatic pneumothorax or hemopneumothorax, except for one patient, who only had signs of lung contusion on simple X-rays. The patient with lung contusion (Case #2) had suspected hemorrhaging of his lung and a computer scan was done to rule out any major intrathoracic injury. Thus, there were 11 cases where CT scans were obtained at initial presentation.

### Table 1: Traumatic pulmonary pseudocysts

<table>
<thead>
<tr>
<th>Case</th>
<th>Blood-filled cavity</th>
<th>Location*</th>
<th>Age (years)</th>
<th>Hemoptysis</th>
<th>Fever/leukocytosis</th>
<th>Resolution time (days)</th>
<th>Initial size (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Completely filled after 2 days</td>
<td>RUL</td>
<td>4</td>
<td>None</td>
<td>14 days/18 days</td>
<td>305</td>
<td>37.57</td>
</tr>
<tr>
<td>2</td>
<td>Non-filled</td>
<td>LUL</td>
<td>7</td>
<td>None</td>
<td>None/4 days</td>
<td>9</td>
<td>13.16</td>
</tr>
<tr>
<td>3</td>
<td>&gt;1/3rd filled after 6 days</td>
<td>LLL</td>
<td>3</td>
<td>None</td>
<td>2 days/5 days</td>
<td>65</td>
<td>39.84</td>
</tr>
<tr>
<td>4</td>
<td>Non-filled</td>
<td>LLL</td>
<td>15</td>
<td>None</td>
<td>None/none</td>
<td>34</td>
<td>17.00</td>
</tr>
<tr>
<td>5</td>
<td>&gt;1/3rd filled</td>
<td>RLL</td>
<td>43</td>
<td>4 days</td>
<td>2 days/6 days</td>
<td>30</td>
<td>36.00</td>
</tr>
<tr>
<td>6</td>
<td>4/5th filled</td>
<td>LLL</td>
<td>48</td>
<td>6 days</td>
<td>8 days/5 days</td>
<td>64</td>
<td>40.00</td>
</tr>
<tr>
<td>7</td>
<td>Non-filled</td>
<td>RUL</td>
<td>42</td>
<td>1 day</td>
<td>None/20 days</td>
<td>34</td>
<td>32.00</td>
</tr>
<tr>
<td>8</td>
<td>Non-filled</td>
<td>RLL</td>
<td>5</td>
<td>None</td>
<td>None/1 day</td>
<td>30</td>
<td>19.32</td>
</tr>
<tr>
<td>9</td>
<td>Completely filled after 1 day</td>
<td>LUL</td>
<td>18</td>
<td>17 days</td>
<td>5 days/25 days</td>
<td>167</td>
<td>39.80</td>
</tr>
<tr>
<td>10</td>
<td>4/5th filled after 1 day</td>
<td>RLL</td>
<td>17</td>
<td>None</td>
<td>1 day/1 day</td>
<td>244</td>
<td>21.00</td>
</tr>
<tr>
<td>11</td>
<td>Non-filled</td>
<td>RLL</td>
<td>2</td>
<td>None</td>
<td>2 days/1 day</td>
<td>17</td>
<td>15.00</td>
</tr>
<tr>
<td>12</td>
<td>Non-filled</td>
<td>RUL</td>
<td>2</td>
<td>None</td>
<td>None/3 days</td>
<td>28</td>
<td>11.63</td>
</tr>
</tbody>
</table>

* RUL, right upper lobe; RLL, right lower lobe; LUL, left upper lobe; LLL, left lower lobe.

Fig. 1. A typical uncomplicated traumatic pulmonary pseudocyst at its initial presentation (arrow, Case #8).

Fig. 2. Complete resolution of the uncomplicated traumatic pulmonary pseudocyst 30 days after the traumatic incident (arrow, Case #8).
and in only one case was the CT scan obtained 3 days later, found incidentally after evaluation of a vertebral fracture (Case #4). Pseudocysts smaller than 2 cm were difficult to identify on simple chest X-rays and in fact, five cases were not identifiable by X-rays alone. There were six patients with fever (50%) and leukocytosis was seen in all but one patient (91.7%). The duration of hemoptysis found in the four patients was 1, 4, 6 and 17 days (Table 1). Associated conditions include lung contusion in 11 patients (91.7%), pneumothorax in 10 patients (83.3%), rib fractures in 7 patients (58.3%), hemothorax in 5 patients (41.7%), and flail chest with respiratory failure in 1 patient (8%). Other associated conditions, other than those of the chest, include extremity fracture in four patients, clavicle fracture in two patients, vertebral fracture in two patients, liver laceration in two patients, and scapula fracture, mandible fracture, and scalp laceration in one patient each. The calculated Injury Severity Score of all the patients ranged from 4 to 11 with a mean of 7.9167. None of our patients had any pulmonary co-morbidities prior to the trauma incident. Although four patients were admitted to the intensive care unit, only one patient needed artificial ventilation. That patient was diagnosed before intubation.

The majority of the pseudocysts occurred on the right side (n = 7); the right lower lobe in four patients, the right upper lobe in three patients, the left upper lobe in three patients, and the left lower lobe in two patients. The size of the traumatic pulmonary pseudocysts as determined by computer tomographic scans showed a mean size of 26.86 mm with a standard deviation of 11.6 mm, ranging from 11.6 to 40.0 mm. The overall mean time for complete resolution was 85.6 days with a standard deviation of 98.2 days. The cases were evenly distributed into the uncomplicated and complicated groups, six cases each. Times to completely blood-filled cavities were 1 day in two patients, and 2 days and 6 days in one patient each. In the other two cases, partial blood filling was found at initial presentation (Table 1). The mean resolution time for the uncomplicated traumatic pulmonary pseudocysts was 25.3 ± 10.1 days and the mean time for resolution for the blood-filled traumatic pulmonary pseudocysts was 145.8 ± 111.4 days, showing a significantly greater resolution time for the complicated group by the independent two-tailed t-test (p = 0.025, SPSS 12.0). There were five patients with pseudocysts less than

Fig. 3. A typical complicated traumatic pulmonary pseudocyst before forming a blood-filled cavity at its initial presentation (arrow, Case #1).

Fig. 4. Blood filling of the cavity has developed in the complicated traumatic pulmonary pseudocyst (arrow, Case #1).

Fig. 5. Resolution of the complicated pulmonary traumatic pseudocyst with remnant scarring (arrow, Case #1).
2 cm and seven patients with pseudocysts greater than or equal to 2 cm. When resolution times were compared according to size, those less than 2 cm showed a mean resolution time of 23.6±10.3 days and those greater than or equal to 2 cm showed a mean resolution time of 129.9±110.1 days. Greater resolution times were shown in the pseudocysts that were greater than or equal to 2 cm with statistical significance shown by the Mann–Whitney U-test (p = 0.013, SPSS 12.0).

4. Discussion

Traumatic pulmonary pseudocysts, occurring after blunt trauma, are a relatively rare event and an infrequently talked about subject, especially, among surgeons. The majority of traumatic pulmonary pseudocysts occur in the young age group. Sorsdahl and Powell [13] reported that 85% of the patients with traumatic pulmonary pseudocysts were under the age of 30 years. In our study, we had similar findings, showing 75% of our 12 cases under the age of 30. We had also found predominance in the male group.

Accurate diagnosis of traumatic pulmonary pseudocysts is done with the help of computer tomography and they are detected by chest radiographs alone in only 50% [14]. In our series, only in four patients were the pseudocysts diagnosed by chest radiographs alone. Chest computer tomographic scans were performed to assess the extent of lung injury in severely injured patients and thus, most pseudocysts were found incidentally.

Manifestations of traumatic pulmonary pseudocysts are hemoptysis, chest pain, cough, dyspnea, mild fever, and leukocytosis. Hemoptysis, occurring in up to 56% of cases, has been reported to continue through the second to fifth day [13]. In our study, chest pain and dyspnea were the most common symptoms.

Traumatic pulmonary pseudocysts may appear immediately or within a few hours after injury and their sizes range from 2 to 14 cm in diameter [4]. Fagan and Swischuk [15] distinguished traumatic pulmonary cysts from cavitating hematomas on the basis of the radiographic appearance of air within the traumatic pulmonary cyst within 48 h. The mean size of the pseudocysts in our study ranged from 11.6 to 40.0 mm and the time from an uncomplicated (less than one-third blood filled) traumatic pulmonary pseudocyst to a completely blood-filled cavity ranged from 1 to 6 days (Figs. 3 and 4).

Differential diagnosis includes ruptured esophagus or herniation of viscera, evacuating hematoma, postneumonic pneumatocele or tuberculous cavity, cavitating bronchial carcinoma, lung abscess, bronchogenic cyst, and pulmonary sequestration [5,6,8,16]. The history of trauma usually delineates any confusion, but if the cavitary lesion in question does not decrease with time, other etiology must be considered.

Treatment of traumatic pulmonary pseudocysts is generally conservative, although there have been five cases of surgical removal due to enormous size or questionable relation to trauma [12,13,17]. Spontaneous resolution of traumatic pulmonary pseudocysts, usually occur within 4 months, unless complicated by a blood-filling cavity. The indications for surgery are failed conservative treatment, development of complications such as infection, respiratory deterioration, an increase in the size of the pseudocyst, or a failure of the pseudocyst to become progressively smaller [3,8]. Joynt and Jaffe [18] recommended conservative treatment as long as evidence of a decrease in the size of the lesion occurred within 6 weeks after the trauma incident in adults and 3–4 months after trauma in children. The use of prophylactic antibiotics is controversial, despite the high incidence of leukocytosis as was seen in our study. All of our patients had prophylactic antibiotics and none of the patients needed surgical intervention. The majority of our patients had leukocytosis at initial presentation and fever was seen in half of our patients. The antibiotics were used more to provide for simple reassurance that the pseudocyst would not become infected. We have a case that had developed an infection that necessitated segmentectomy in another branch of our hospital, although, not included in our study.

We had found a statistically significant greater resolution time when comparing uncomplicated traumatic pulmonary pseudocysts with the blood-filled pseudocysts and found that if the size of the traumatic pulmonary pseudocyst was greater than or equal to 2 cm a significantly greater time for resolution was needed. Sorsdahl and Powell [13] had mentioned that when pulmonary hematomas evolve, a longer resolution time at an average of 17 weeks is needed. This correlates well with the results in our study, which shows a mean resolution time of 145.8 days for the blood-filled traumatic pulmonary pseudocysts.

5. Conclusions

In our study, chest pain and dyspnea were the most common presenting symptoms of traumatic pulmonary pseudocysts. Statistically significant delays were found in the resolution times of blood-filled pseudocysts and in pseudocysts greater than or equal to 2 cm. Surgical intervention was unnecessary and conservative treatment was possible in all of our cases.

Acknowledgement

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References


