Short Communication

Autologous blood-patch pleurodesis for secondary spontaneous pneumothorax with persistent air leak

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Introduction

Pneumothorax with a persistent air leak that does not resolve under prolonged tube thoracostomy suction is usually treated surgically. However, patients with severe pulmonary diseases such as progressive pulmonary fibrosis and chronic pulmonary emphysema are not good candidates for surgical treatment. Chemical pleurodesis with tetracycline has been reported and accepted as a treatment for recurrent pneumothorax (1–5). However, it is ineffective when the lungs of the patients are deflated. Moreover, chemical pleurodesis with tetracycline has been reported to induce inflammation and symptosis between the visceral and parietal pleura. As an alternative method for pleurodesis, autologous blood injection into the pleural space has been reported for the treatment of spontaneous pneumothorax (6,7). These reports described a successful treatment with autologous blood injection for pneumothorax patients with or without residual pleural space. The purpose of this study was to evaluate the efficacy and safety of autologous blood-patch pleurodesis for secondary spontaneous pneumothorax with a persistent air leak, including pneumothorax patients whose lungs were not inflated before the injection of blood.

Patients and Methods

This study was undertaken between January 1994 and January 1997. Eleven patients (10 men and one woman) were enrolled. Informed consent was obtained from all patients. They ranged in age from 22 to 83 years. All patients had a lung with a persistent air leak that had not resolved under prolonged tube thoracostomy suction for more than five days. Since one patient had pneumothorax on the other side, and five patients had recurrent pneumothorax at various intervals, we performed the procedure for 17 occurrences in 11 patients. All patients had underlying conditions, such as severe lung diseases, with a high surgical risk (Table 1). Thus they were not good candidates for thoracotomy. When autologous blood pleurodesis was undertaken, the lung was inflated in 10 instances but not in seven by tube thoracostomy suction.

We performed the procedure according to the method described by Dumire et al. (6). Briefly, autologous blood (50 ml) without anticoagulant was obtained from each patient. As soon as the blood was drawn from the patient, it was immediately injected into the pleural space through a double-lumen chest tube that attaches to the rubber injection plug for the administration of drugs. The connected tube was elevated 60 cm above the patient and left to water-seal for 2 h. During this period, the patients were asked to change their position in bed frequently. Thereafter, suction was reapplied. When the air leak continued for more than 2 days, we repeated autologous blood infusions...
We treated 11 patients for 17 occurrences of pneumothorax with a persistent air leak. The lungs were inflated in 10 of those but not inflated in seven under prolonged tube thoracostomy suction when pleurodesis was performed. After the final treatment including the initial and the repeated injection with autologous blood, the persistent air leak was resolved in 10 instances (59%). Six were from 10 instances of inflated lung (60%), and four were from seven instances with deflated lungs (57%) (Table 2). There were no harmful effects such as fever, nausea or pain. The follow-up in this study ranged from 2 months to 2 years. There were two recurrences. One developed after 5 months and another occurred after 8 days. Repeated autologous blood-patch pleurodesis was accomplished in both cases, and the procedure was successful.

Blood-patch pleurodesis has been reported for the treatment of pneumothorax with a persistent pulmonary air leak. Robinson reported blood pleurodesis in 25 patients with spontaneous pneumothorax (8). He treated the patients with blood pleurodesis after the air leak had stopped and the lung had expanded. He used autologous blood as one of the sclerosing agents instead of tetracycline or talc. Autologous blood-patch pleurodesis for a persistent pulmonary air leak was first reported in two cases by Dumire et al. (6). The lungs in their patients were fully inflated. Moreover, Mallen et al. reported that autologous blood-patch pleurodesis was effective in one pneumothorax patient with residual air space (7). Although the mechanism of autologous blood pleurodesis is not clear, Dumire et al. assumed that: 1. the blood-patch effect, that is, blood coagulation, seals the air leak; and 2. the actual pleurodesis occurs afterwards by inflammation and scarring. Therefore, we speculated that autologous blood-patch pleurodesis would be effective for patients with residual air space in pneumothorax or a deflated lung with a persistent air leak. In fact, we demonstrate in this study that autologous blood-patch pleurodesis was performed in seven instances of deflated lung, and was effective in four (Table 2). However, considering the initial treatment of autologous blood injection, four of 10 patients (40%) with inflated lungs and only one of seven patients with deflated lungs were successfully treated. These findings suggested that the repeated injection would be required for achieving the autologous blood-patch pleurodesis.

As for the harmful effects of autologous blood injection, we did not observe any adverse effects such as fever, nausea or pain in our series. No harmful effects have been observed by others (6,7), except for one study which reported pleural infection only in one patient for an overall incidence of 4% (8). Pain and fever are major problems to manage under chemical pleurodesis with tetracycline. As for the autologous blood injection, sedation and antipyresis were not required during the procedure.

Spontaneous pneumothorax is subclassified as primary and secondary. Chronic obstructive pulmonary diseases are the most frequent underlying conditions in secondary spontaneous pneumothorax. The initial treatment of secondary spontaneous pneumothorax is tube thoracostomy. After 7 days of tube thoracostomy drainage, the lung remains deflated or the air leak persists in about 20% of patients (9, 10). These patients are surgically treated with thoracotomy or thoracoscopy under general anaesthesia. However, those who are of advanced age or have severe underlying diseases and complications are at risk for general anaesthesia or surgical treatment, and an alternative treatment would be required. The chemical pleurodesis method with tetracycline is accepted for recurrent pneumothorax (1–5). However, the treatment is thought to be effective when the procedure is done after the air leak has stopped and the lung has expanded. A large-scale prospective, randomized clinical trial of tetracycline pleurodesis by Light et al. (11) has also suggested that teracycline administration had no effect on the patients with persistent air leaks and the closure of bronchopleural fistula. In contrast to tetracycline, autologous blood pleurodesis rarely induces severe inflammation and scarring, and the destruction of the pleura. In addition, the procedure is safe and effective for patients with a residual air space in pneumothorax or with an unexpanded lung with a persistent air leak.

In conclusion, we showed that blood-patch pleurodesis was effective in patients with a persistent air leak in pneumothorax, even if they had an underlying disease with residual air in the pleural space. This procedure is also simple and inexpensive. When patients with pneumothorax have severe underlying pulmonary diseases such as pulmonary fibrosis and chronic pulmonary emphysema and the tetracycline chemical pleurodesis or surgical treatment was not appreciated, autologous blood-patch pleurodesis appears to be worth consideration for the treatment of pneumothorax with persistent air leak, including pneumothorax patients whose lungs were not inflated before the injection of blood.

### Table 2. Results of autologous blood-patch pleurodesis

<table>
<thead>
<tr>
<th></th>
<th>Inflated lung</th>
<th>Deflated lung</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Success (n)</td>
<td>Failure (n)</td>
</tr>
<tr>
<td></td>
<td>Success (n)</td>
<td>Failure (n)</td>
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<tr>
<td>Blood injections (n)</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>2</td>
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<tr>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total (n)</td>
<td>6</td>
<td>4</td>
</tr>
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</table>

once more. The chest tube was removed 2 days after the air leak stopped and the lungs were expanded. The patient was observed for at least 1 week after removing the chest tube. When the air leak stopped within 2 days of autologous blood injection, and no recurrence of pneumothorax was observed for more than 1 week, the procedure was judged to have been effective.

Results and Discussion

We treated 11 patients for 17 occurrences of pneumothorax with a persistent air leak. The lungs were inflated in 10 of those but not inflated in seven under prolonged tube thoracostomy suction when pleurodesis was performed. After the final treatment including the initial and the repeated injection with autologous blood, the persistent air leak was resolved in 10 instances (59%). Six were from 10 instances of inflated lung (60%), and four were from seven instances with deflated lungs (57%) (Table 2). There were no harmful effects such as fever, nausea or pain. The follow-up in this study ranged from 2 months to 2 years. There were two recurrences. One developed after 5 months and another occurred after 8 days. Repeated autologous blood-patch pleurodesis was accomplished in both cases, and the procedure was successful.

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References