Treatment of Infected Bulla with Alcohol Sclerosis Combined with Percutaneous Catheter Drainage: A Preliminary Report

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Purpose: To evaluate effectiveness of alcohol sclerosis combined with percutaneous catheter drainage (PCD) for treatment of infected bulla.

Materials and Methods: Infected bulla in four consecutive patients were treated. In all patients, percutaneous catheter drainage of the bulla was performed. Instillation of sterile alcohol (99% ethanol) was carried out into the cavity of the bulla. Alcohol was left in the cavity for approximately 30 minutes in each session. Alcohol instillation was repeated according to the size of bulla. Patients were subsequently followed up with serial chest radiographs and CT scans.

Results: All patients showed significant improvement both clinically and radiologically. Disappearance of the bulla and reexpansion of surrounding lung parenchyma was observed in two patients and partial resolution (80% reduction in size) was seen in another two patients. Complications included mild chest pain during instillation of alcohol in all patients and delayed radiating shoulder pain in one patient.

Conclusion: We provisionally conclude that intracavitary alcohol instillation combined with PCD is effective in the treatment of the infected bulla.

Index Words: Emphysema, pulmonary
Lung, interventional procedure
Alcohol

INTRODUCTION

The current treatment options of the bulla include limited resections, primarily local excision or plication of visible bulla or both (1), and rarely segmental resection or pneumonectomy (2). However, high mortality and operation risk exist in surgical treatment (1-3).

Percutaneous catheter drainage (PCD) in the thorax is the generally accepted method in treatment of lung abscess and pleural effusion (4-5). Dean et al (6) treated successfully an infected bulla by using percutaneous catheter drainage in a patient receiving positive pressure ventilation.

Percutaneous catheter drainage and then alcohol sclerosis (PCDAS) in the patients with infected bulla may be used for draining the infected material in the bulla by former method and for obliteration of the bulla to relieve compression to the adjacent normal lung by the latter.

The purpose of our study was to report preliminary results of the treatment of PCDAS in four patients with infected bullae.

MATERIALS and METHODS

PCDAS was performed in 4 consecutive patients with infected bulla from November 1991 and January 1995. The patients were four men, ranging in age from 53 to 63 years (median, 58).

To be included, patients met the following criteria: (a) The infected bulla showed inadequate response to treatment with antibiotics. (b) The bulla did not disappear with simple catheter drainage. (c) Initially CT scan demonstrated bulla with air fluid level. (d) The pati-
Patients were at high risk for resection and in severe pulmonary compromised state.

The infected bulla was defined on the basis of CT findings; emphysematous spaces of more than 1 cm in diameter in the inflated lung, usually containing a fluid level but not necessarily demarcated from surrounding lung by curved hairline shadows(2). All patients met these criteria.

Clinical symptoms of patients included dyspnea (n=4), coughing with sputum (n=4), fever (n=1), and chills (n=1). One patient had pulmonary tuberculosis with diffuse emphysema; the other three had chronic obstructive pulmonary disease and diffuse emphysema without evidence of concurrent parenchymal diseases.

Patients were given 50 mg Pethidine Hydrochloride and 0.5 mg Atropin Sulphate subcutaneously as premedication before the definite procedure of PCDAS. After antiseptic preparation of the puncture site and local analgesia with 1% Xylocaine, a small puncture wound was made. After needle aspiration of fluid to be analyzed for protein and glucose levels, cell count, Gram stain, and culture, an 8-F drainage catheter with six side holes (Percuflex, Medi-technic/Boston Scientific, Watertown, Mass) was inserted. In three patients, a single 8-F catheter was inserted under fluoroscopic guidance into the infected bulla demonstrated at CT. In one patient, two 8-F catheters were inserted under fluoroscopic guidance into each infected bullae demonstrated at CT. After catheter insertion, fluid was

Fig. 1. Complete resolution of infected bulla in a 63-year-old male after percutaneous catheter drainage with alcohol sclerosis.

a. Chest radiograph shows large bulla with air-fluid level in right upper lung zone. Remaining lungs appear emphysematous.
b. Chest radiograph after instillation of contrast media into bullous cavity by using fine needle shows large round bulla in right upper lung zone.
c. Follow-up chest radiograph after percutaneous catheter drainage with alcohol sclerosis shows shrinkage of bulla and disappearance of air-fluid level.
d. Follow-up chest CT obtained 24 months after treatment shows complete disappearance of bulla. Irregular lines are visible in areas of previous bulla.
drained via the catheter, which was connected to water-seal suction (negative pressure of 20 cm H₂O). Drainage was stopped within 2 days in all cases.

Treatment with alcohol sclerosis began when little or no drainage (<10 mL/day) appeared. Before alcohol sclerosis therapy, we performed tubogram at fluoroscopy in order to confirm no leakage into the pleural cavity or no communication into the bronchus. We started instillation of sterile ethyl alcohol 99% (Hayman Co., Witham, England) after complete aspiration of previous injected contrast material. The procedure was carried out as described previously by Bean and Rodan in 1985 for treatment of hepatic cysts (7). We used about 35% replacement volume of alcohol in a single session. At each session alcohol was injected slowly; the amount administered was 20–100 mL at one time, according to volume of lesion. Smaller bullae were treated two or three times with alcohol instillation in single session, and larger bullae were treated four or five times. This procedure was performed two sessions a week. After two sessions for lesions smaller than 100 mL in volume and four sessions for those larger than 100 mL, therapeutic effect was assessed with follow-up CT.

Alcohol was left in the bulla for approximately 10 minutes. The patient rolled into various positions, side to side, at several-minute intervals so that the alcohol may come into contact with all surfaces of the cystic

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Fig. 2. Partial resolution of infected bulla after alcohol sclerosis in a 51-year-old male.

a. Chest radiograph shows large ovoid bulla with air-fluid levels in left upper and middle lung zones, extending to right hemithorax through mediastinum.

b. Chest radiograph after instillation of contrast media shows large lobulated bulla in left upper and middle lung zones. A part of bulla (arrows) is not opacified.

c. CT scan obtained at the level of bronchus intermedius shows large ovoid bulla with air-fluid level in the left upper lung zone extending across anterior mediastinum to right hemithorax.

d. Follow-up CT sixth month after treatment shows partial resolution of bulla. Air-fluid level in cavity disappeared.
cavity. And then alcohol was withdrawn. Degree of shrinkage of the bulla was monitored with fluoroscopy. If patients had a pain during the instillation of alcohol, the procedure was aborted and the alcohol was aspirated, usually with rapid abatement of symptoms. At the completion of therapy, the catheter was removed and skin was bandaged.

In all patients, the total amount of alcohol administered was 120–1600 mL. Follow-up CT and radiography were obtained at 1, 6, 12, and 24 months after removal of the catheter.

RESULTS

All patients showed significant improvement in both clinical and radiological parameters (Table 1). The infected bullae that were treated were located in the right upper lobe in three patients and in the left upper lobe in one. Three patients had one infected bulla and the remaining patient had two infected bullae. The size of the infected bulla ranged from 6 × 6 to 18 × 20 cm.

Two patients showed complete resolution (Fig. 1) and another two patients showed partial resolution (80% reduction in volume) (Fig. 2). Aspirated volumes of the infected bulla ranged from 20 to 660 mL. The volume of bulla was less than 100 mL in two patients and larger than 100 mL in another two. The diameters of the bulla ranged from 6 to 20 cm in diameter (mean 10.5 cm). Fluid cytology and cultures were negative in all patients probably because the patients received oral and intravenous antibiotics before admission.

The duration of catheter indwelling in the bulla ranged from 12 to 40 days (mean: 26 days). The duration of catheters lodging in large bulla (mean; 35 days) was longer than in small bulla (18 days). Three patients needed alcohol instillation twice and the remaining one patient needed four times. After the procedure of PCDAS, pulmonary function test (FEV1, FVC, VC) showed improvement in four patients (Table 1). The catheter was removed at 5–7 days after the completion of PCDAS. Follow-up period ranged from 13 to 36 months (Table 1).

Complications included mild chest pain during the procedure in all patients and delayed radiating shoulder pain in one.

DISCUSSION

The purpose of alcohol sclerisis for infected bulla is twofold. First, if the bulla is ventilated, it merely contributes to the physiological dead space since the attenuated or destroyed alveoli within it are invariably unperfused. Second, and more important, even if the bulla is relatively unventilated, as it enlarges it not only destroys surrounding lung tissue but also compresses the potentially functioning lung. Removal of the bulla thus permits expansion of collapsed alveoli, decreases airway resistance, and increases dynamic compliance.

The role of antibiotics in treatment of the bulla with air-fluid remains speculative. Peters et al (8) reported that complete resolution of symptoms and air-fluid levels on chest radiograph occurs in patients with bulla over two to 32 weeks (mean, 12 weeks). Stark et al (9) described that all fluid cleared from the bulla, taking an average of about 6 weeks. But, bulla persisted in lungs. Truly infected bulla should be managed conservatively even though medical treatment is often unsuccessful because of the poor communications between the infected bulla and the bronchial tree. Surgical indications for resection are the same as for primary lung abscesses; failure of response to a 6 week course of adequate medical management; suspicion of occult bronchial carcinoma; and specific complications of the abscess, such as hemoptysis or free pleural space rupture (2).

Large intrapulmonary infected bulla presents a considerable therapeutic problem, particularly if their respiratory reserve is low, because of the risks of open operation (10).

Most authors agree that preventive surgery is legitimate when the bulla occupies half or more of the hemithorax compressing the normal lung, or has enlarged over a period of years (1–3). In the treatment of bulla, Witz and Roeslin (11) reported a mortality rate of 1.5% for 151 patients with relatively normal lungs, but mortality was 11% in patients with diffuse emphysema. Most deaths resulted from respiratory failure, pleuropulmonary infection, or contralateral pneumothorax (11).

Table 1. Summary of Data in Percutaneous Drainage and Alcohol Sclerosis of the Thoracic Infected Emphysematous Bullae.

<table>
<thead>
<tr>
<th>No</th>
<th>Age /Sex</th>
<th>Bullae Size(cm)</th>
<th>Alcohol therapy</th>
<th>Pulmonary Function Test</th>
<th>Complication</th>
<th>Follow-up (month)</th>
<th>Catheter Duration(day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pre</td>
<td>Post</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Session FVC</td>
<td>FEV1 FVC/FEV1</td>
<td>FVC FEV1 FVC/FEV1</td>
<td>mild pain</td>
<td>36</td>
</tr>
<tr>
<td>1</td>
<td>63/M</td>
<td>6×6</td>
<td>2 1.19</td>
<td>0.51 57(%)</td>
<td>1.86 1.62 87(%)</td>
<td>mild pain</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>54/M</td>
<td>7×6</td>
<td>2 1.90</td>
<td>1.35 73(%)</td>
<td>1.99 1.62 84(%)</td>
<td>mild pain</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>61/M</td>
<td>14×10</td>
<td>4 2.13</td>
<td>1.19 56(%)</td>
<td>2.03 1.27 63(%)</td>
<td>mild pain</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>53/M</td>
<td>18×20</td>
<td>4 1.92</td>
<td>1.36 71(%)</td>
<td>1.98 1.85 93(%)</td>
<td>mild pain</td>
<td>36</td>
</tr>
</tbody>
</table>
Computed tomography is a sensitive diagnostic tool of delineation of bullous area, because it clearly shows the full extent of bullous disease, which is sometimes not discernible on simple chest PA and lateral radiographs (12). All our patients were examined with pre-procedural and follow-up chest CT routinely.

Percutaneous catheter drainage alone removed air or fluid of infected bulla, however, bulla per se persisted in the lung. The bulla compressed normal lung parenchyma and the symptoms were not relieved. Follow-up radiographs after PCD showed persistent bulla.

After alcohol sclerosis, the size of the bulla showed decrease and shrinkage in size on follow-up radiographs. Furthermore, normal parenchyma expanded and replaced the shrunken lobe or lung. Therefore, treatment of infected bulla with PCDAS is more effective than PCD alone.

Size of the bulla was a critical factor in predicting postoperative improvement in patients presenting with dyspnea (3). Removal of bulla occupying less than one third of the hemithorax did not result in significant increment in pulmonary function. By contrast, removal of giant bulla occupying 70 to 100 percent of one hemithorax almost invariably led to significant relief of dyspnea and marked increment in pulmonary function. However, removal of vaguely defined bulla or bullous areas in advanced diffuse emphysema rarely caused significant changes in FEV1.

In our cases, the size of the infected bulla ranged from 6 to 20 cm. The volume of the largest infected bulla was marked and therefore treatment of the bulla with PCDAS incurred significant increments in pulmonary function. In our study, the threshold volume for improvement of symptom or pulmonary function after simple percutaneous drainage for infected bulla was above 6 x 6 cm in size. Symptoms were relieved uniformly when the infected bulla were decompressed by PCDAS. A small remnant of the bulla (10-20% of the original size) were observed on follow-up studies in two patients, whereas complete disappearance were in another two patients.

In summary, we successfully treated four consecutive patients with infected bulla by PCDAS. We provisionally conclude that intracavitary alcohol treatment of the infected bulla in patients with severe pulmonary compromise is simple, safe and effective, although further studies are necessary to determine indications, instillation dosage of alcohol, method, and timing of the procedure.

REFERENCES

감염된 폐기종낭의 경피도관배액술을 이용한 알코올 경화치료법: 예비적 보고

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목 적: 감염된 폐기종낭의 경피도관배액술을 이용한 알코올 경화법의 효과를 평가하고자 한다.

대상 및 방법: 감염된 폐기종낭 4명의 환자에서 시행하였다. 모든 환자는 감염된 폐기종낭에 경피도관배액술을 시행하였다. 알코올로 (99% ethanol) 낭 내강을 치료하였다. 알코올은 한번 시술시 30분을 유지하였다. 알코올 주입은 낭종의 크기에 따라 반복하였다. 모든 환자는 연속적인 단순흉부사진과 전산화단층촬영으로 추적하였다.

결 과: 모든 환자는 임상적으로나 방사선학적으로 현저한 호전이 있었다. 감염된 폐기종낭의 완전소실과 주위의 폐조직의 팽창은 2명의 환자에서 보였다. 낭종 크기의 80%이상 감소하는 부분 홍수는 2명에서 보였다. 합병증으로 시술시 모든 환자에서 알코올 접촉시 경미한 흉통이 있으나, 1명의 환자에서는 간갑골로 파지는 동통이 있었다.

결 론: 경피도관배액술을 이용한 알코올 경화법은 감염된 낭종의 치료에 효과적인 방법이라고 잠정적인 결론을 내릴 수 있을 것으로 사료된다.