



Autologous Blood Patch Pleurodesis in the Management of Persistent Air Leak Secondary to Pneumothorax

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Abstract

Background: Persistent air leak (PAL) is a common complication of pneumothorax and is associated with prolonged hospitalization, increased healthcare costs, and significant morbidity. Autologous blood patch pleurodesis (ABPP) has emerged as a simple and minimally invasive alternative for the management of PAL. **Aim:** To evaluate the effectiveness and safety of autologous blood patch pleurodesis in patients with persistent air leak secondary to pneumothorax. **Methods:** A retrospective case series was conducted at a tertiary care center involving eight patients with persistent air leak following pneumothorax who underwent autologous blood patch pleurodesis. Demographic characteristics, clinical profile, procedural details, treatment outcomes, and complications were analyzed. The primary outcome was successful cessation of air leak. Secondary outcomes included time to air leak resolution, duration of chest tube drainage, hospital stay, and procedure-related complications. **Results:** The mean age of the patients was 46.8 ± 15.2 years, with males accounting for 75% of cases. Secondary spontaneous pneumothorax was the most common indication (62.5%). The mean duration of air leak before pleurodesis was 8.6 ± 2.3 days. Most patients (75%) achieved successful resolution after a single pleurodesis session. Overall success was observed in 87.5% of patients, with a mean time to cessation of air leak of 2.1 ± 1.1 days. The mean duration of chest tube drainage after pleurodesis was 3.4 ± 1.5 days, and the mean hospital stay was 5.3 ± 2.2 days. Minor complications included transient fever and chest pain in one patient each. No empyema or major adverse events were encountered. **Conclusion:** Autologous blood patch pleurodesis is an effective, safe, and economical treatment option for persistent air leak secondary to pneumothorax, demonstrating high success rates and minimal complications.

Keywords: Autologous blood patch pleurodesis; Persistent air leak; Pneumothorax; Pleural disease; Chest tube drainage; Secondary spontaneous pneumothorax; Lung re-expansion.



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INTRODUCTION

Pneumothorax is a common respiratory emergency characterized by the presence of air within the pleural cavity, resulting in partial or complete lung collapse. It may occur spontaneously in otherwise healthy individuals (primary spontaneous pneumothorax), in patients with underlying lung disease (secondary spontaneous pneumothorax), or following trauma and invasive procedures. Although intercostal chest tube drainage remains the cornerstone of management, a significant proportion of patients develop persistent air leak (PAL), which is generally defined as continuous air leakage lasting beyond 5–7 days despite appropriate pleural drainage. Persistent air leak is associated with prolonged hospitalization, increased healthcare expenditure, patient discomfort, and a higher risk of complications such as pleural infection and recurrent pneumothorax^[1,2]. The annual incidence of primary spontaneous pneumothorax has been reported to range from 7.4 to 18 cases per 100,000 men and 1.2 to 6 cases per 100,000 women, whereas secondary spontaneous

pneumothorax occurs at a rate of approximately 6.3 cases per 100,000 men and 2 cases per 100,000 women annually^[3].

Secondary spontaneous pneumothorax is particularly common among patients with chronic obstructive pulmonary disease (COPD), pulmonary tuberculosis sequelae, interstitial lung disease, and other chronic pulmonary disorders. Persistent air leak develops in approximately 15–25% of patients with secondary spontaneous pneumothorax and may necessitate additional interventions beyond conventional chest drainage^[4]. Surgical management using video-assisted thoracoscopic surgery (VATS) with pleurodesis or bullectomy is considered the definitive treatment for prolonged air leak^[5]. However, many patients are poor surgical candidates because of advanced age, compromised pulmonary reserve, multiple comorbidities, or limited access to thoracic surgical services. Consequently, less invasive alternatives have

gained increasing attention. Among these, autologous blood patch pleurodesis (ABPP), first described by Robinson in 1987, involves the instillation of the patient's own venous blood through an existing chest tube into the pleural cavity to promote sealing of the air leak and pleural symphysis^[6]. Several studies have demonstrated favorable outcomes with ABPP in managing persistent air leaks. Dumire et al. reported successful closure of prolonged air leaks in postoperative thoracic surgery patients using autologous blood instillation^[7]. Andreotti et al. observed high success rates and shorter duration of air leak among patients treated with ABPP compared with conservative management^[8].

A systematic review by Chambers et al. concluded that autologous blood pleurodesis is a safe, inexpensive, and effective intervention for persistent air leak, with success rates frequently exceeding 80% and minimal procedure-related morbidity^[9]. More recent evidence has continued to support its utility in both spontaneous and postoperative pneumothorax settings, particularly in resource-limited environments where surgical intervention may not be readily available^[10]. Despite growing international evidence, published data from Indian tertiary care centers remain limited. Variations in patient characteristics, underlying pulmonary diseases, and healthcare resources necessitate local evaluation of treatment outcomes. Therefore, the present case series was undertaken to assess the effectiveness and safety of autologous blood patch pleurodesis in the management of persistent air leak secondary to pneumothorax and to contribute additional evidence regarding its role as a practical bedside intervention in routine clinical practice.

Aim

To evaluate the effectiveness and safety of autologous blood patch pleurodesis in the management of persistent air leak among patients with pneumothorax.

Objectives

1. To assess the rate of successful cessation of persistent air leak following autologous blood patch pleurodesis.
2. To determine the duration required for air leak resolution and chest tube removal after the procedure.

To evaluate procedure-related complications and short-term clinical outcomes associated with autologous blood patch pleurodesis.

MATERIALS AND METHODS

Study Design and Setting

This retrospective case series was conducted in the Department of Pulmonary Medicine and Thoracic Surgery of a tertiary care teaching hospital. The study included patients diagnosed with persistent air leak secondary to pneumothorax who underwent autologous blood patch pleurodesis (ABPP) between January 2023 and December 2025. Institutional Ethics Committee

approval was obtained prior to data collection, and patient confidentiality was maintained throughout the study.

Study Population

The study included all consecutive patients with persistent air leak following pneumothorax who were treated with autologous blood patch pleurodesis during the study period. A total of eight patients fulfilled the eligibility criteria and were included in the analysis.

Inclusion Criteria

1. Patients aged 18 years and above.
2. Patients with primary spontaneous, secondary spontaneous, or traumatic pneumothorax.
3. Presence of persistent air leak lasting more than 5 days despite appropriate intercostal chest tube drainage.
4. Patients who underwent autologous blood patch pleurodesis as part of their treatment.

Exclusion Criteria

1. Patients with active pleural infection or empyema.
2. Patients with coagulation disorders or severe thrombocytopenia.
3. Patients who underwent immediate surgical intervention without an attempt at autologous blood patch pleurodesis.
4. Incomplete medical records.

Procedure of Autologous Blood Patch Pleurodesis

All patients had a functioning intercostal chest drain in situ at the time of the procedure. Under strict aseptic precautions, 50–100 mL of autologous venous blood was obtained from a peripheral vein. The collected blood was immediately instilled through the chest tube into the pleural cavity without anticoagulant. Following instillation, the chest tube was elevated above the level of the patient and left unclamped to prevent the development of tension pneumothorax while minimizing blood drainage. Patients were encouraged to change positions periodically for approximately two hours to facilitate uniform distribution of blood within the pleural space. The air leak was monitored clinically and by observing bubbling in the underwater seal drainage system. Repeat chest radiographs were obtained to assess lung expansion and resolution of pneumothorax. A second blood patch procedure was performed in selected patients if persistent air leak continued after the initial intervention.

Data Collection

Patient records were reviewed and the following variables were collected:

- Age and sex
- Smoking history
- Underlying pulmonary disease
- Type and side of pneumothorax
- Duration of air leak before pleurodesis

- Volume of blood instilled
- Number of pleurodesis sessions
- Time to cessation of air leak
- Duration of chest tube drainage after pleurodesis
- Length of hospital stay
- Procedure-related complications
- Recurrence during follow-up

Outcome Measures

Primary Outcome

The primary outcome was successful cessation of persistent air leak following autologous blood patch pleurodesis, defined as complete disappearance of bubbling in the chest drainage system with sustained lung expansion on chest radiography.

Secondary Outcomes

Secondary outcomes included:

- Time required for cessation of air leak.
- Duration of chest tube drainage after pleurodesis.
- Length of hospital stay.

- Procedure-related complications such as fever, chest pain, infection, empyema, or respiratory deterioration.
- Recurrence of pneumothorax during follow-up.

Follow-up

Patients were followed up in the outpatient department for a minimum period of three months after discharge. Clinical assessment and chest radiography were performed when indicated to detect recurrence of pneumothorax or delayed complications.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation (SD), whereas categorical variables were presented as frequencies and percentages. Given the descriptive nature of the study and small sample size, only descriptive statistical analysis was performed.

RESULTS

Table 1. Demographic and Baseline Characteristics of Patients (n=8)

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
18–30	2	25.0
31–50	3	37.5
>50	3	37.5
Gender		
Male	6	75.0
Female	2	25.0
Mean Age (years)	46.8 $\pm$ 15.2	-
Smoking History		
Present	5	62.5
Absent	3	37.5
Comorbid Lung Disease		
COPD	3	37.5
Pulmonary Tuberculosis Sequelae	2	25.0
None	3	37.5

Most patients were males (75%) with a mean age of 46.8 years. Smoking history was present in 62.5% of cases.

Table 2. Clinical Profile and Characteristics of Pneumothorax (n=8)

Variable	Frequency (n)	Percentage (%)
Type of Pneumothorax		
Secondary Spontaneous Pneumothorax	5	62.5
Primary Spontaneous Pneumothorax	2	25.0
Traumatic Pneumothorax	1	12.5
Side Involved		
Right	5	62.5
Left	3	37.5
Duration of Air Leak Before ABPP		
5–7 days	3	37.5
8–10 days	3	37.5
>10 days	2	25.0
Mean Duration of Air Leak (days)	8.6 $\pm$ 2.3	-

Secondary spontaneous pneumothorax was the commonest indication (62.5%), with a mean pre-procedure air leak duration of 8.6 days.

Table 3. Procedural Characteristics of Autologous Blood Patch Pleurodesis (n=8)

Variable	Frequency (n)	Percentage (%)
Volume of Blood Instilled		
50 mL	2	25.0
75 mL	1	12.5
100 mL	5	62.5
Number of ABPP Sessions		
Single Session	6	75.0
Two Sessions	2	25.0
Mean Blood Volume Instilled (mL)	87.5 ± 20.3	-

Most patients received 100 mL of autologous blood, and three-fourths achieved resolution after a single pleurodesis session.

Table 4. Treatment Outcomes Following Autologous Blood Patch Pleurodesis (n=8)

Outcome Variable	Value
Successful cessation of air leak, n (%)	7 (87.5)
Failure requiring surgical intervention, n (%)	1 (12.5)
Mean time to cessation of air leak (days)	2.1 ± 1.1
Mean duration of chest tube after ABPP (days)	3.4 ± 1.5
Mean hospital stay after ABPP (days)	5.3 ± 2.2

Autologous blood patch pleurodesis successfully sealed persistent air leaks in 87.5% of patients, with air leak cessation occurring within a mean of 2.1 days.

Table 5. Procedure-Related Complications and Follow-Up Outcomes (n=8)

Variable	Frequency (n)	Percentage (%)
Complications		
No complication	6	75.0
Mild fever	1	12.5
Chest pain requiring analgesics	1	12.5
Empyema	0	0.0
Recurrent pneumothorax during follow-up	1	12.5
Complete lung expansion at discharge	7	87.5

Complications were minimal and self-limiting. No empyema or severe adverse events occurred, and complete lung expansion was achieved in most patients.

DISCUSSION

Persistent air leak (PAL) remains a challenging complication of pneumothorax, often resulting in prolonged hospitalization and increased morbidity. Autologous blood patch pleurodesis (ABPP) has emerged as a simple, minimally invasive, and cost-effective intervention for sealing persistent air leaks, particularly in patients who are unsuitable for surgical management. The present case series evaluated the efficacy and safety of ABPP in eight patients with persistent air leak secondary to pneumothorax. In the present study, the mean age of patients was 46.8 ± 15.2 years, and males constituted 75% of the study population. This male predominance is consistent with the epidemiology of spontaneous pneumothorax reported by Bense et al., who observed a significantly higher incidence among males, particularly smokers^[11].

Similarly, Andreetti et al. reported that most patients undergoing ABPP for persistent air leak were middle-aged males with underlying pulmonary pathology^[8]. Secondary spontaneous pneumothorax accounted for 62.5% of cases in our series, while primary spontaneous pneumothorax and traumatic pneumothorax represented smaller proportions. This finding is comparable to the observations of Tschopp et al., who reported that PAL occurs more frequently in secondary spontaneous pneumothorax because of underlying structural lung disease and impaired healing of alveolopleural fistulas^[4]. The predominance of patients with chronic lung disease in our study further supports this association.

The mean duration of air leak before ABPP was 8.6 ± 2.3 days. Similar durations have been reported in previous

studies evaluating autologous blood pleurodesis. Robinson, who first described the technique, utilized ABPP in patients with prolonged air leaks persisting beyond one week and demonstrated favorable outcomes^[6]. Likewise, Droghetti et al. employed ABPP in patients with persistent postoperative air leaks after conservative management had failed^[10]. A successful outcome was achieved in 87.5% of patients in the present study. This success rate closely parallels those reported in earlier investigations. Dumire et al. achieved successful closure of persistent air leaks in approximately 84% of cases treated with autologous blood pleurodesis^[7]. Andreotti et al. reported success rates exceeding 90% following blood patch pleurodesis after pulmonary resection^[8]. Furthermore, the systematic review by Chambers et al. demonstrated pooled success rates ranging from 75% to 95%, supporting the effectiveness of this intervention across diverse patient populations^[9]. The mean time to cessation of air leak following pleurodesis in our study was 2.1 ± 1.1 days. This finding is comparable to that reported by Andreotti et al., who observed rapid resolution of air leaks within 48–72 hours in the majority of patients receiving ABPP^[8]. Early closure of the air leak contributes to faster lung re-expansion and facilitates earlier chest tube removal.

Most patients in our series (75%) required only a single ABPP session, whereas two patients underwent a repeat procedure. Similar findings have been documented by Droghetti et al., who noted that a single blood patch was sufficient in most cases, with repeat instillation required only when air leakage persisted^[10]. The ability to repeat the procedure safely represents an additional advantage of ABPP over more invasive interventions. The mean duration of chest tube drainage after pleurodesis was 3.4 ± 1.5 days, and the mean post-procedure hospital stay was 5.3 ± 2.2 days. Previous studies have similarly reported reductions in chest tube duration and hospitalization following successful blood patch pleurodesis. Chambers et al. concluded that ABPP can shorten hospital stay and reduce the need for surgical referral, thereby lowering overall treatment costs^[9]. With regard to safety, only minor complications were encountered in the present study, including transient fever and mild chest pain in one patient each. No cases of empyema, severe infection, respiratory deterioration, or procedure-related mortality were observed. These findings are consistent with those of Dumire et al. and Robinson, who reported minimal adverse effects associated with autologous blood pleurodesis^[6,7]. The absence of major complications further reinforces the favorable safety profile of the procedure. Overall, the findings of the present case series are in agreement with existing literature demonstrating that autologous blood patch pleurodesis is an effective and safe therapeutic option for persistent air leak secondary to pneumothorax. The high success rate, rapid resolution of air leak, low complication rate, and ease of bedside administration

support its role as an attractive alternative to surgery, particularly in resource-limited settings and among patients with significant comorbidities.

CONCLUSION

Autologous blood patch pleurodesis (ABPP) proved to be an effective, safe, and minimally invasive treatment modality for the management of persistent air leak secondary to pneumothorax. In this case series, successful cessation of air leak was achieved in the majority of patients, with rapid lung re-expansion and a low rate of complications. Most patients required only a single pleurodesis session, resulting in reduced duration of chest tube drainage and shorter hospital stay. The procedure was well tolerated, with only minor and self-limiting adverse events observed. Given its simplicity, low cost, bedside feasibility, and favorable safety profile, ABPP represents a valuable therapeutic option, particularly in patients who are poor candidates for surgery or when surgical intervention is not readily available. Larger prospective studies are warranted to further establish its efficacy and long-term outcomes in diverse patient populations.

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