

Study of the Relative Frequency of Spontaneous Pneumothorax Recurrence with Two Policy Therapies: A Clinical Trial

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Abstract

Background: Spontaneous pneumothorax is a potentially fatal condition with a high risk of recurrence. The purpose of this study is to compare two different approaches to SP management. In the first group, patients underwent only chemical pleurodesis; in the second group, CT-scan, VATS, and then chemical pleurodesis was performed.

Materials and Methods: This study is a non-randomized clinical trial conducted on 65 patients admitted to Al-Zahra Hospital in Isfahan with a primary complaint of sudden dyspnea and a definitive diagnosis of spontaneous pneumothorax. Two studies compared the main outcomes of recurrence within six months and the time until recurrence.

Results: Age, sex, and BMI were matched between the two study groups. The side of the pneumothorax, smoking history, and pulmonary disease history did not differ significantly ($P > 0.05$). Pneumothorax recurrence did not differ significantly between the two groups ($P: 0.477$).

Conclusion: This study demonstrated no distinction between VATS and chemical pleurodesis when using only chemical pleurodesis. However, because numerous studies have suggested that one of these techniques may be beneficial for patients with SP, it is recommended to conduct additional randomized controlled trials (RCTs) with a more detailed plan and more comparable procedures, although it appears that meta-analysis design may be effective given the abundance of available RCT studies.

Keywords: Pleurodesis, pneumothorax, surgery, thoracic, thoracic surgeries, video-assisted

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INTRODUCTION

Spontaneous pneumothorax (SP) is a condition that manifests as sudden dyspnea and chest discomfort. It affects men more than women, with an incidence rate of 7.4 and 1.2 in the USA, respectively.^[1] The exact etiology of this disease is unknown. However, it appears that one of the major causes is the growth of the lung parenchyma during puberty.^[2] SP is managed according to various protocols; the British Thoracic Society recommends non-operative management, while the American College of Chest Physicians strongly recommends interventions to treat the SP's emergent condition.^[3,4] The

recurrence rate of SP has been reported in various studies using diverse clinical approaches. Walker (2018) reported a recurrence rate of 32% in patients with SP treated with pleural aspiration or chest drainage.^[5] Macduff (2010) found a 54% recurrence rate in the first year after non-operative management.^[3]

According to NL Vuong *et al.*, VATS interventions have a lower recurrence rate than thoracotomy with mechanical pleurodesis.^[6] VATS was superior to thoracotomy in pain control and recovery.^[7,8] After one year, mechanical pleurodesis

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alone had a recurrence rate of 2-3.6%,^[9,10] whereas adding talc powder to chemical pleurodesis had a surprising effect (0-3.2% recurrence) in patients with SP.^[11] While other procedures such as fibrin sealants and ablative therapy have been studied, they are not widely used in clinics. The purpose of this study is to compare two methods of treating SP: the first group received CXR and chemical pleurodesis, while the second group received CT-Scan and VATS followed by chemical pleurodesis.

MATERIALS AND METHODS

Study design

The present study is a non-randomized interventional clinical trial. The first group consisted of patients who underwent CXR and were treated with tube thoracoscopy and chemical pleurodesis with 2gr tetracycline powder after being diagnosed with SP, as opposed to patients admitted for CT-Scan and then underwent VATS and chemical pleurodesis.

Study population

The study population consisted of 65 patients admitted to Al-Zahra Hospital in Isfahan with sudden dyspnea and a definitive diagnosis of spontaneous pneumothorax. Patients with a history of spontaneous pneumothorax were excluded, as were those with a history of thoracotomy or any other thoracic intervention.

Study method

Following sample selection, one group underwent CXR and chemical pleurodesis (**Group 1 (n: 32)**), whereas the second group underwent chest CT-Scan and bullectomy via VATS, followed by chemical pleurodesis if apparent bullae were visible on the CT-scan images. Additionally, if their CT scan did not reveal bullae, they underwent only chemical pleurodesis (**Group 2 (n: 33)**). Both of these procedures were performed in a clinic. Chemical pleurodesis was performed using 2 grams of tetracycline in a 200 mg solution of lidocaine 2% in 50 cc's of normal saline injected via chest tube to soak the viscera, parietal and mediastinal pleura, and diaphragm. After one hour, the chest tube was clamped and connected to suction at a pressure of -20 cmH₂O.

All patients in group 2 who were VATS candidates, sedated with double-lumen intubation, and single-lung ventilation. In patients with blebs or bullae, staple bullectomy and parietal pleurectomy were performed. After the procedure, careful hemostasis with electrocautery was performed over the post-bullectomy surface to minimize the risk of hemothorax. Chemical pleurodesis was performed in these patients using the same technique as VATS. All patients' basic information was reviewed and recorded, including their age, gender, BMI, history of smoking, lung diseases, and the incidence of pulmonary pneumothorax. All patients were evaluated and followed for six months following the intervention for pneumothorax recurrence, and the time of its occurrence was also evaluated and recorded.

Data analysis

After gathering the necessary data, it was entered into the SPSS (ver. 26) software. The descriptive statistics section utilized an independent student t test and Chi-square test to analyze data. The significance level for all statistical tests was considered P value <0.05 .

RESULTS

The mean age of patients with CXR and chemical pleurodesis was 40.03 ± 17.79 years in this study and 42.09 ± 17.66 years in the second group. Independent sample t test with a significance level of $P: 0.641$ revealed no significant correlation. As Chi-square indicated, the gender distribution was also matched ($P: 0.48$) [See Table 1]. The two groups did not have significantly different body mass indexes ($P: 0.786$). When the background medical diseases associated with the intervention outcome were examined, it was discovered that both groups had a more significant history of smoking. However, $P: 0.273$ demonstrated that there was no significant difference between groups. History of pulmonary disease was also matched, as indicated by the Chi-square statistical test ($P: 0.553$). The side of the pneumothorax was also assessed, and the majority of cases in both groups had a unilateral right-sided pneumothorax, although this finding was not statistically different between the two groups ($P: 0.461$), [See Table 2].

Pneumothorax recurrence was not significantly different between the two groups ($P: 0.477$); 6 (18.8%) patients who received CXR and only chemical pleurodesis exhibited recurrent pneumothorax, whereas 5 (15.2%) patients who received CT-Scan and VATS with chemical pleurodesis demonstrated recurrent pneumothorax. Pneumothorax development time was also evaluated and is shown in Figure 1. This variable was negligible; 83.33 ± 36.11 days in six chemical pleurodesis patients versus 108.6 ± 34.98 days in five VATS with chemical pleurodesis patients. Chemical

Table 1: Patient background of the two groups

Variable (Background)	Technique 1 (n: 32)	Technique 2 (n: 33)	P
Age (Years)	40.03±17.79	42.09±17.66	0.641*
Gender (Male/Female)	27 (84.4)/5 (15.6)	29 (87.9)/4 (12.1)	0.48**
BMI (Kg/M ²)	24.12±4.22	23.84±3.93	0.786

BMI=Body Mass Index. *Independent Sample t test, ** Chi-Square

Table 2: Independent variables of the two groups

Variable (Independent)	Technique 1 (n: 32)	Technique 2 (n: 33)	P
History of Smoking (Yes/No)	28 (87.5)/4 (12.5)	26 (78.8)/7 (21.2)	0.273*
Side of pneumothorax (Right/Left)	19 (59.4)/13 (40.6)	21 (63.6)/12 (36.4)	0.461*
History of pulmonary Disease (Yes/No)	17 (53.1)/15 (46.9)	18 (54.5)/15 (45.5)	0.553*

*Chi-Square

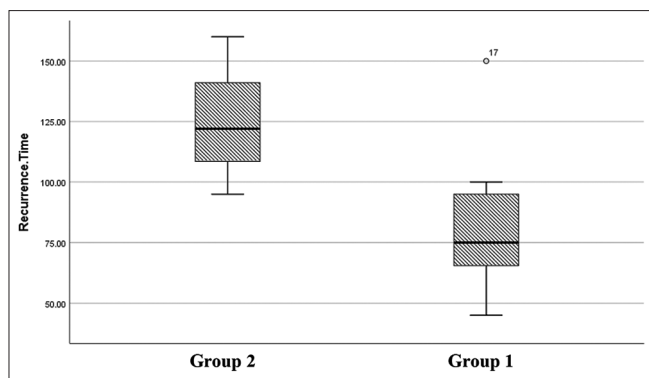


Figure 1: Mean time (day) between pneumothorax recurrences in two studied groups

pleurodesis was performed on all patients who received CXR in group one, but only 16 (48.5%) of patients referred for CT-Scan underwent VATS due to the apparent bullae on their diagnostic CT scans.

DISCUSSION

SP is a potentially fatal condition in the population. Although it is more frequently seen in young and thin male adults, concerns remain regarding its management, as recurrence is possible. As a result, the management of SP is of particular clinical importance. Chemical pleurodesis versus VATS with chemical pleurodesis and various mechanical and chemical pleurodesis techniques have been extensively investigated,^[12-14] but disagreements persist. For instance, the Belgian society of pneumology's guideline recommends conservative management for limited and asymptomatic SP, while needle aspiration or tube thoracostomy is recommended for symptomatic SP without pleurodesis. In comparison, surgical approaches such as pleurectomy or pleural abrasion, as well as a combination of VATS and chemical pleurodesis, are strongly recommended for large and recurrent pneumothorax or SP with persistent air leak or incomplete lung expansion following a suspected follow-up period.^[15]

The British Thoracic Society's 2010 pleural disease guideline concurs, recommending surgery for spontaneous recurrent pneumothorax or complicated SP, such as continuous air leak.^[3] The findings of this study confirmed that there is no clinically significant difference. The difference in recurrence of spontaneous pneumothorax is statistically significant for both procedures (mechanical and chemical pleurodesis). However, Sim SKR *et al.* reported a lower recurrence rate in patients receiving mechanical pleurodesis than in patients receiving chemical pleurodesis^[16] in their meta-analysis in 2019. However, Moreno-Merino S *et al.*^[17] discovered that mechanical pleurodesis caused more air leaks than chemical pleurodesis. Mechanical pleurodesis can be performed in various ways, including partial or complete pleurectomy, apical ligation, or pleural abrasion.^[16]

Pleurectomy, according to some, has a lower recurrence rate than other mechanical pleurodesis but results in increased

postoperative pain and a more extended hospital stay.^[18] Certain studies demonstrated that when mechanical pleurodesis such as bullectomy is combined with chemical pleurodesis such as minocycline, the outcome is improved.^[19,20] Elsayed HH *et al.* reported that VATS plus chemical pleurodesis with talc powder resulted in superior clinical outcomes in patients with secondary spontaneous pneumothorax due to a higher immediate success rate, a lower rate of spontaneous pneumothorax recurrence, and a lower mortality rate compared to talc pleurodesis via chest tube replacement.^[21] Other chemical agents, such as iodopovidone, have been investigated previously, Lee KH^[22] believe that minocycline has a faster postoperative recovery than iodopovidone. Though talc is widely accepted as a chemical agent for chemical pleurodesis,^[16] Campos JR *et al.* reported talc-induced acute respiratory syndrome in 1996,^[23] and fever associated with pleurodesis was more common with talc in the Park JB *et al.* study.^[24]

It appears that assessing the risks associated with all procedures is critical and must be considered. Minor complications such as pain and fever or dyspnea have been reported frequently,^[25,26] as have significant complications such as empyema, pneumonia, hemothorax, and persistent air leak. Despite all evidence to the contrary, most thoracic surgeons worldwide nowadays prefer to manage cases based on their experience and facilities.

Although the components of this study attempted to take a step toward better decision-making by surgeons in the management of spontaneous pneumothorax, prospective randomized clinical trials are needed to achieve a more reliable result.

CONCLUSION

Because the occurrence of SP is a life-threatening condition that requires immediate management, choosing the best management strategy for SP is of critical clinical importance. However, this study found no difference between patients who received CXR and then chemical pleurodesis and those who received CT-Scan and VATS (in patients with bullae) followed by chemical pleurodesis. Nonetheless, numerous studies have suggested chemical pleurodesis or chemical pleurodesis via mechanical pleurodesis for patients with SP, and it is recommended to conduct additional clinical RCTs with a more detailed plan and more comparable procedures. However, given the abundance of available RCT studies, it appears that meta-analysis design can be effective.

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Ethical approval

This study is approved by the ethics committee of Isfahan University of Medical Sciences with the code of IR.MUI.MED.REC.1398.184.

Informed consent

Written Informed consent was provided and given to all of the participants of this study.

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No financial support or sponsorship was used in this study.

Conflicts of interest

There are no conflicts of interest.

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