

Comparison of the efficacy Talc solution injection through Chest Tube and Talcum Powder through Pleuroscopy for the Treatment of Malignant Pleural Effusion: a randomized clinical trial

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Abstract

Background: The aim of the present study was to compare the different outcomes and response rates of talc powder injection via chest tube and talc spray through thoracoscopy in the treatment of malignant pleural effusion in patients.

Methods: In this randomized controlled trial, patients with malignant pleural effusion, who were hospitalized in the surgery and hematology-oncology departments of Shariati and Imam Khomeini Hospitals, were enrolled. The patients were randomly divided into two groups: chest tube and pleuroscopy, using simple randomization. The mean and standard deviation, frequency and percentage, independent sample t-tests, chi-square, and Fisher's exact tests were used for data analysis. A p-value of less than 0.05 was considered statistically significant.

Results: No significant difference was observed between the two groups in the incidences of chest pain, fever, and both symptoms ($p > 0.05$). The treatment success rates among the chest tube and pleuroscopy cases were 83.3% and 100%, respectively, and there was no significant difference between the two groups ($p = 0.05$). Among the five patients who had a recurrence, four (80%) had lung cancer, and one (20%) had liver cancer, and this difference was significant ($P = 0.003$). Regarding the rate of response to the treatment according to the side with effusion, among the people who had a relapse, two people (40%) had right-sided effusion, and three others (60%) had left-sided effusion ($P = 0.623$).

Conclusions: Both techniques were safe, had minor side effects, were transient, and easy to manage. However, the recurrence of the disease in the thorascopic pleurodesis method was significantly less than in the chest tube.

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Introduction

The pleura is a significant membrane that envelops the lung parenchyma, mediastinum, diaphragm, and ribs. This structure is bifurcated into visceral and parietal pleura. The visceral pleura envelops the lung parenchyma at points of contact with the chest wall, diaphragm, mediastinum, and interlobar fissures [1,2]. The parietal pleura, on the other hand, covers the inner surface of the thoracic cavity and is divided into costal, mediastinal, and diaphragmatic parietal pleura. Typically, a layer of liquid, known as pleural fluid, exists between the visceral pleura and the wall,

servicing as a lubricant [3, 4].

Malignancies involving the pleura are the third leading cause of pleural effusion. Approximately 50% of patients with metastatic cancers suffer from a malignant pleural effusion [5]. The existence of malignant pleural effusion in these patients signifies that these tumors are inoperable and reduces patient survival [6-8]. The quality of life for patients with malignant pleural effusion diminishes due to symptoms such as dyspnea, cough, among others [9]. Chemical pleurodesis, which involves injecting a sclerosant into the pleural space, is typically used in recurrent malignant pleural effusion [10]. Talc is the

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most common sclerosing agent compared to others due to its affordability and minimal side effects [6, 11]. In the Terra study, sixty-six pleural catheters (bilateral in 2 patients) and fifty-two cases of pleurodesis were performed with talc. No complications were reported during catheterization or pleurodesis. However, complications after pleurodesis included catheter blockage in four patients and empyema in one patient [6].

Given the frequency and significant impact of malignant pleural effusion on the quality of life of patients suffering from various malignancies, it is crucial to identify an effective treatment method to alleviate the symptoms caused by this condition and to provide an effective and low-complication palliative treatment method for these patients. Owing to the importance of this issue, the current study aimed to compare the response rate to the treatment of malignant pleural effusion in two ways: talc powder injection through a chest tube and talc spray through thoracoscopy in patients referred to the surgery departments of Shariati and Imam Khomeini hospitals in Tehran, Iran.

Method

In this randomized controlled trial, patients with malignant pleural effusion, who were hospitalized in the surgery and hematology-oncology departments of Shariati and Imam Khomeini Hospitals, were enrolled. The success of two treatment methods, namely the injection of talc solution through a chest tube and talc powder through pleuroscopy in treating malignant pleural effusion, was evaluated.

Inclusion Criteria

The inclusion criteria comprised patients with clinical, radiographic, chemical, and cytological analyses of pleural fluid consistent with malignant pleural effusion. The exclusion criteria included the presence of pleural effusion without confirmation of malignant origin, absence of indications for pleurodesis treatment, inability to tolerate chest tube placement, non-expansion of the lung after pleural fluid drainage, pregnancy, survival expectancy less than three months, and lack of patient satisfaction. Before initiating the study, all steps, such as the goals and different interventions, were explained to each of the participating patients (or, if necessary, the patient's companions). After informing the patient, informed consent was obtained.

Randomization and Interventions Studied

Patients were randomly divided into two groups

using simple randomization. In the first group, a talc solution was injected through a chest tube No. 28 F; in the second group, talc powder was injected through pleuroscopy. In the chest tube, 5 grams of asbestos-free talcum powder and ten ccs of 1% lidocaine ampoule were dissolved in 100 ccs of lukewarm normal saline and injected through a 2 cm incision. The chest tube was clamped for one hour and then connected to the suction with a negative pressure of 20 mm Hg for one hour. Then the suction was stopped, and when the daily drainage of the chest tube reached less than 100 milliliters per day, the chest tube was removed. Finally, the patients were discharged from the hospital one day after the chest tube removal if there were no other indications for continued hospitalization. In the pleuroscopy group, the patients were transferred to the operating room without chest tube insertion; a 2 cm incision was made under local anesthesia and sedation, and 5 grams of talcum powder was injected through the pleuroscopy; and then, the chest tube was inserted from the same incision. When the amount of chest tube drainage reached less than 100 milliliters per day, the chest tube was removed, and finally, if there were no other indications, the patients were discharged from the hospital one day after the chest tube was removed.

After the operation, the patients did not receive non-steroidal anti-inflammatory drugs and steroids, and narcotic drugs were used to control the patient's pain

It should be noted that the incision was 2 cm in both groups. In the pleuroscopy group, the camera was inserted from the given incision and from the side, and under the pleuroscopy, talc powder was spread in the pleural space. After performing the pleurodesis process, the patient was examined to follow up the response to the treatment and control the complications and recurrence of the disease. Other diagnostic tests were performed one month after the operation. The radiographs obtained from the patients at the beginning of the study and after the desired procedures were performed by an experienced radiologist unaware of the content of the intervention or treatment. Improvement of clinical symptoms and resolution of radiological findings indicating pleural effusion were considered complete improvements. The return of clinical symptoms after the initial improvement or re-effusion after the complete drainage of the fluid or its reduction is defined as the recurrence of the disease. In all stages of the study, the information obtained from the history and examination of the patients was recorded in a particular study checklist containing information such as sex, age, duration of pleural effusion, type of underlying malignancy leading to lateral effusion, initial and serial radiographic findings, and findings

from the analysis of the peripheral fluid.

Statistical analysis methods

The mean and standard deviation were calculated for continuous variables, and frequency and percentage were calculated for qualitative variables. Independent sample t-tests, chi-square, and Fisher's exact tests were used to compare the two groups. A p-value less than 0.05 was considered a statistical significance level. All analyses were performed using the SPSS version 25 software.

Results

Baseline characteristics

In this study, 60 individuals were randomly divided into two groups: the chest tube group and the pleuroscopy group, with 30 cases in each group. The average age of patients in the chest tube group was 57.76 ± 8.53 years, while in the pleuroscopy group, it was 48.33 ± 15.8 years. The chest tube group consisted of 20 women (66.7%) and 10 men (33.3%), whereas the pleuroscopy group included 21 women (70%) and 9 men (30%). The prevalence of shortness of breath was 21 (70%) in the chest tube group and 20 (66.7%) in the pleuroscopy group, with no significant differences between the two groups (p: 0.89). No significant difference was observed between the two groups regarding other factors such as the prevalence of lung, breast, liver, and ovarian cancers. More details are provided in Table 1.

Comparison outcomes after the intervention

The incidences of chest pain in the chest tube and pleuroscopy groups were 33.3% and 26.7%, respectively, with no significant difference between the two groups (p: 0.57). The incidence of fever in the chest tube and pleuroscopy groups were 20% and 6.7%, respectively, and this difference was not statistically significant (p: 0.12). The incidence of both symptoms (pain and fever) was the same in the two groups (p: 0.99). Furthermore, no significant difference was observed between the two groups in the incidence of infection and the side of effusion (p: 0.99 and 0.19, respectively). The treatment success rates in the chest tube and pleuroscopy groups were 83.3% and 100%, respectively, with no significant difference between the two groups (p: 0.05) (Table 2). Among the five patients who experienced a recurrence, four (80%) had lung cancer, and one (20%) had liver cancer, and this difference was significant (P=0.003) (Figure 1). In terms of the rate of response to treatment according to the side with effusion, among the individuals who had a relapse, two (40%) had right-sided effusion, and three (60%) had left-sided effusion, and this difference was not significant (P=0.623) (Figure 2).

Discussion

Talc pleurodesis is now recognized as a treatment candidate for malignant pleural effusion [12], but the

Table 1: Comparison baseline parameters between two groups

Variable	Chest tube (n:30)	Pleuroscopy (n:30)	p
Age	57.76± 8.53	48.33± 15.80	0.39
Female gender	20(66.7)	21(70)	0.66
Shortness of breath	21(70)	20(66.7)	0.89
Pain	3(10)	6(20)	0.15
Pain and shortness of breath	6(20)	6(20)	0.95
Lung cancer	14(46.7)	7(23.3)	0.06
Breast cancer	12(40.0)	15(50)	0.43
Liver cancer	1(3.3)	0(0.0)	0.98
Ovarian cancer	2(6.7)	4(13.3)	0.67
Stomach cancer	1(3.3)	2(6.7)	0.98
Lymphoma	0(0.0)	2(6.7)	0.49

Table 2: Comparison of different outcomes after the intervention between two groups

Complication	Chest tube (n:30)	Pleuroscopy (n:30)	p
Chest pain	10 (33.3)	8 (26.7)	0.57
Fever	6 (20)	2 (6.7)	0.12
Chest pain and fever	2 (6.7)	2 (6.7)	0.99
Without any complication	12(40)	18(12)	0.12
Infection	1(3.3)	0(0.0)	0.99
Success in treatment	25(83.3)	30(100.0)	0.05
The side with effusion			
The right side	16(53.3)	12(40)	
The left side	13(43.3)	13(43.3)	0.19
Two-sided	1(3.3)	5(16.7)	

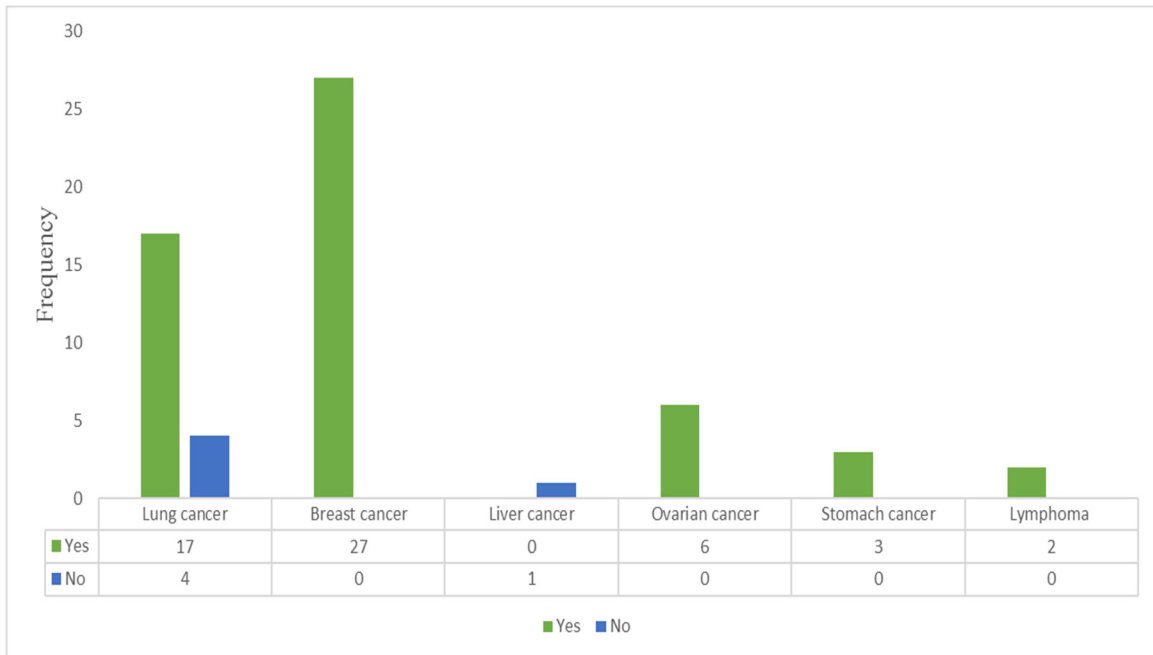


Figure 1: Success in treatment based on types of cancers

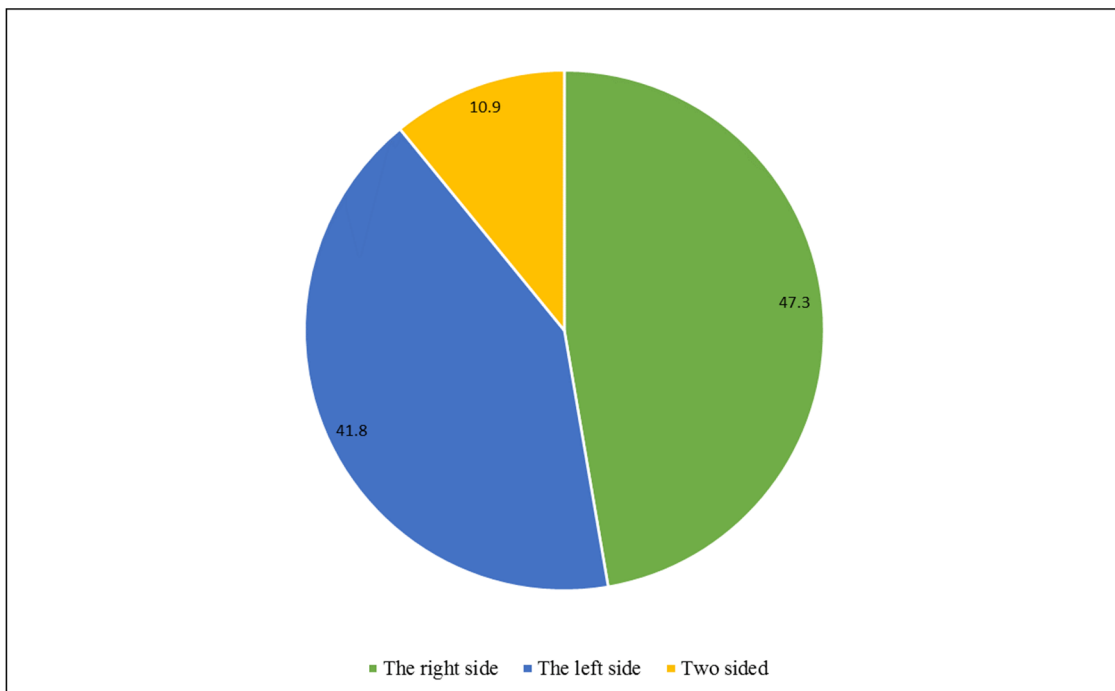


Figure 2: Success in treatment based on the side with effusion

appropriate method for using talc is still debated. Several studies have reported satisfactory results with chest tube and pleuroscopy methods, but most were performed in a single clinic with few sample sizes. Also, most of these studies only considered one of the two mentioned techniques, and it is difficult to recognize the statistical population with little

difference within the studies due to differences in symptoms, the definition of recurrence, subset of malignancies, and patients [3, 13-15]. Recurrence of the disease may be considered by radiological signs, clinical symptoms, or the need to use therapy. Studies show that breast cancer seems to be associated with better outcomes [16], mesothelioma and lung cancer

with worse outcomes [17].

The present study aimed to determine the response rate to the treatment of malignant pleural effusion between the two methods of injecting talc solution through a chest tube and talc powder through pleuroscopy in patients with malignant pleural effusion. According to the results, the most common complications were chest pain and fever. The incidence of chest pain was slightly more common in the chest tube group. It should be considered that patients who underwent surgery had their pain controlled by an anesthesiologist. At the same time, there were no recommendations for pain control for patients in the chest tube group other than adding a local anesthetic to the talc solution. Also, patients in the pleuroscopy group were given systemic narcotics in case of postoperative pain. However, the pain was minor, short-lived, and easily manageable in many patients, and the fever was also mild.

The average age of the patients in the current study was 53 years, and 68.3% of the patients were women. In Bladi's study, the average age of patients with pleural effusion treated with chronic hemodialysis was 48 years, and the men and women ratio was approximately equal [18]. In a study by Bizhani, the patient's age average was 57 years [4]; in another study, in 70 patients with pleural effusion, 63% of the patients were men, and the average age of the patients was 56 years [19], which shows that the average age of the mentioned studies is higher than the current study, which can be justified considering that the present study was conducted only in patients with malignant pleural effusion. In Kolschmann's study, 55.8% of affected patients were male [5]. In Safavi's study in Tehran, the average age of patients was 57.6 years, and 51% were male. The ratio of men to women is lower than in the present study. In Cardillo's study, 61.2% of patients with malignant pleural effusion were men, and the average age of the patients was 61.2 years [20] which is higher than the average age of the present study. The possible causes of existing differences can be due to different understudied populations, different sample sizes, differences in the studied malignancies, and so on.

In this study, recurrence was not observed in 91.7% of patients during the follow-up period. However, disease recurrence was reported in 8.3% of patients. Post-surgery, fever was observed in 8 patients (3.13%), chest pain in 18 patients (30%), and both symptoms in 4 patients (7.6%).

According to Reddy's study [21], pleurodesis was successful in 92% of patients, a finding similar to this study. The complications reported included fever in two patients, pleural catheter insertion in one patient, and empyema in one patient.

In Kilic's study [2], a recurrence of fluid was

observed in 13.2% of patients within 90 days of follow-up in the talc group, indicating a success rate of 86.8%. Recurrence was observed in the tetracycline group in 26.7% of patients (73.8% success) and the bleomycin group in 35.7% of patients (64.3% success). There was a significant difference between the groups studied, suggesting that talc reduces recurrences more effectively than the tetracycline and bleomycin groups.

Viallat's study [14] reported successful pleurodesis in 90.2% of patients in the first month of follow-up. Side effects included one case of death three days after the procedure in a patient in the final stage of the disease, fever in 9.8% of patients, empyema in 2.5%, and pulmonary infection in 0.8% of patients.

In Kolschmann's study [5], successful pleurodesis was achieved in 82.6% of patients. The 30-day mortality rate was 16.7% (17 patients). The only observed side effect was empyema, seen in one patient. No case of ARDS (adult respiratory distress syndrome) caused by pleurodesis was reported.

Mitrofan's study [22] associated the use of talc as a sclerosing agent with success. Side effects included chest pain in 25% of patients, fever in 15% of patients, empyema in 4.5% of patients, prolonged air leakage in 4% of patients, lung infection in two patients, and acute respiratory failure in one patient. In a one-month follow-up, pleurodesis was successful in 92% of patients.

The Terra study [3] reported no complications during catheterization or pleurodesis. Recurrence was reported in 13.9% of patients during 30 days of follow-up. According to the results of this study, pleurodesis with talc was effective with few complications, reducing the need for hospital admission.

Sahn SA's study [23] was conducted in three groups, including thorascopic talc poudrage (TP), talc slurry (TS), and no intervention, to control pleural effusion malignancy. No complications during catheterization or pleurodesis were reported in these patients. Complications after pleurodesis were few and included chest pain in 6% of patients and fever in 1%, which is less than this study. The recurrence rate during follow-up was reported to be about 15%. The relative success rate was 87.5% in the thorascopy group and 73% in the chest tube group. This success ratio was similar to the results of this study.

Conclusion

The current study demonstrated that both techniques were safe, exhibited minor side effects, were transient, and were manageable. However, the thorascopic pleurodesis method had significantly fewer recurrences. Moreover, it is recommended that patients with lung cancer undergo the thorascopic

method to reduce the risk of recurrence. Given the higher success rate of the pleuroscopic approach compared to the chest tube, it is advised to be performed whenever there is a need to treat pleural effusion. In other cases, the chest tube method remains a valuable option.

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