

Comparative Study between Different Agents Used in Chemical Pleurodesis

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ABSTRACT

Background: Pleurodesis is a medical technique used to eliminate the gap among the parietal and visceral pleura in order to avoid the reoccurrence of pleural effusion or pneumothorax.

This method involves the introduction of a chemical substance into the pleural space, which leads to the scarring and adhesion of the membranes.

Objective: The objective of this research was to evaluate the outcomes of medical pleurodesis utilizing three distinct agents and two delivery routes.

Patients and methods: Our university hospital treated 135 individuals who had recurrent malignant and benign pleural effusions with pleurodesis by employing three distinct chemical agents: povidone-iodine solution, bleomycin ampoules, and fresh frozen plasma (FFP), administered by two different methods, namely chest tube and small-bore pigtail catheter.

Results: All patients were dyspneic. Seventy were men; their ages varied from 45 to 76. Chest tubes were used for effusion drainage and sclerosing agent instillation in eighty-seven individuals (64.45 percent), whereas pigtail catheters were used in forty-eight individuals (35.55). With 83 cases of malignant effusion and 52 cases of non-malignant effusion, 60 cases were treated with bleomycin, 30 with fresh frozen plasma (FFP), and 45 with povidone-iodine. Sclerosing agent type was associated with a change in overall success rate.

Conclusion: FFP is a good alternative sclerosing agent to bleomycin and it is safe, available and less costly.

Keywords: pleurodesis, pleural effusion, sclerosing agents and chest tube.

INTRODUCTION

Pleural effusions are anomalous accumulations of fluid found within the pleural space. They frequently arise due to increased fluid production beyond what the body needs and/or impaired lymphatic absorption. It is the most prevalent sign of pleural disease, and its causes vary from systemic inflammatory conditions and cardiopulmonary disorders to cancer⁽¹⁾.

The typical pleural space holds approximately ten mL of fluid, which is the result of the equilibrium between hydrostatic and oncotic pressures in the capillaries of the visceral and parietal pleura, as well as continuous drainage through the sulcal lymphatic system. Pleural effusions can occur due to disturbance of this inherent equilibrium⁽²⁾.

The presence of a pleural effusion indicates an underlying illness process, which can originate from either the lungs or other parts of the body. Additionally, this condition can be either acute or chronic^(1,6). While the causes of pleural effusion can vary greatly, the majority of cases are attributed to congestive heart failure, pneumonia, malignancy, or pulmonary embolism⁽³⁾. According to the mechanism of formation of pleural fluid and chemical analysis of it, the pleural effusion can be classified into two types transudate which is formed as a result of imbalance between oncotic and hydrostatic pressure, and exudates type which is formed by inflammatory process in the pleura⁽⁴⁾.

Chemical pleurodesis is a therapeutic process that is used to build a connection between the parietal and visceral pleura by introducing different chemical agents into the pleural space^(1,3). Chemical pleurodesis primarily used to treat two primary clinical conditions:

recurrent pleural effusion (PE) and recurrent spontaneous pneumothorax⁽⁵⁾.

Exposure of pleural mesothelial cells to a sclerosing agent leads to the secretion of various mediators, involving chemokines as interleukin 8 (IL-8) and monocyte chemoattractant protein (MCP-1), in addition to growth factors like vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF), basic fibroblast growth factor (bFGF), and transforming growth factor- β (TGF- β). Mesothelial cells and their cytokines are crucial in initiating and sustaining several pathways of pleural inflammation and pleural space obliteration⁽⁵⁾.

The objective of the present investigation was to evaluate the outcomes of medical pleurodesis by utilizing three distinct chemical agents: povidone-iodine solution, bleomycin ampoules, and fresh frozen plasma, administered through two different methods, namely chest tube and small-bore pigtail catheter.

PATIENTS AND METHODS

Site and time of research: Our prospective research started at February 2021 till June 2023 in our Cardiothoracic Department in Al-Azhar University Hospital.

Ethical considerations:

Approval of institutional Research Board of Al-Azhar University was obtained. We followed the declaration of Helsinki as regards trial on humans. Patients were informed and they signed written consent for participation in our study, operation, and publishing of clinical data.

Sample data

This study involved 135 cases, 70 men and 65 women. Their ages varied from 45–76 years (51 ± 7.02). 3 sclerosing agents were utilized: 60 cases received bleomycin, 30 cases received FFP, and 45 cases received povidone–iodine. 2 routes of delivery were applied either chest tube (87 cases (64.45%)), or small catheter (48 cases (35.55%))

Chest X-ray (CXR) was performed for all patients but not all of them underwent CT chest.

Firstly, all patients underwent thoracentesis, either by chest tube or pig tail catheter then after well drainage of the pleural effusion and the drainage was less than 100cc/day, sclerosing agent was injected to pleural cavity; 500 cc of FFP, bleomycin sixty mg ampoules, or twenty mL of ten percent povidone–iodine was then added to a solution of fifty cm³ of sterile saline 0.9 percent and ten ml of two percent xylocaine.

The choice of sclerosing agents depended on their availability and physician preference, then catheter or chest tube was clamped for 12 hours and cases were asked to rotate in all possible positions to allow sclerosing agent to distribute all over the pleural space, then the chest tube or catheter was opened, and the patients were followed up for drainage and investigated with chest X-ray, if there was no drainage occurred or was less than 100cc per day; this was considered success pleurodesis and the chest tube or catheter was removed and patients were discharged and follow up occurred outpatient (14,15).

Data management: Data were collected, entered and analyzed by IBM SPSS version 23, the qualitative variables were presented as number and percentages, the quantitative data were presented as mean, standard deviation and ranges. The comparison between groups regarding qualitative data was done by **Chi-square test**.

The p-value was considered significant as the following:

- P-value > 0.05: Non significant
- P-value < 0.05: Significant
- P-VALUE < 0.01: HIGHLY SIGNIFICANT

RESULTS

135 individuals suffering from recurrent pleural effusion participated in our investigation; all of them exhibited dyspnea. Men comprised 70 (48.1%) of the cases, while women comprised the remaining 65 (51.9%). The age of the cases varied between 45 and 76 years (mean 51 ± 7.02). 70 cases (51.8%) exhibited a New-York Heart Association (NYHA) IV class of dyspnea, while 35 cases (26%), classified as NYHA III, and 30 cases (22.2%) exclusively exhibited a NYHA II class of dyspnea. In relation to additional symptoms, fifty cases reported coughing, forty cases experienced discomfort, and forty-five cases reported both. In eighty cases, the re-accumulation of pleural effusion occurred rapidly, whereas in 55 cases, it occurred gradually.

83 cases had malignant pleural effusion, 25 cases had cirrhotic liver and 27 cases had chronic renal failure. A chest X-ray revealed that fifty individuals had a left-sided pleural effusion, and eighty-five individuals (56.7%) had a right-sided effusion. Of the individuals, 81 (69.2%) had moderate effusion and 54 (58.7%) had significant effusion (Table 1).

Table 1: Demographic data of patients in this study

Data	Bleomycin	FFP	Povidone–iodine
Number	60	30	45
Mean of age	50	52	54
Sex male	32	16	22
female	28	14	23
Malignant effusion	36	19	28
Hepatic dysfunction	12	6	7
Renal dysfunction	13	5	9
Moderate effusion	35	21	27
Severe effusion	24	13	17
NYHA II	14	6	10
NYHA III	16	8	11
NYHA IV	33	15	22

The different sclerosing agents were used in malignant and non-malignant patients through chest tube or pig tail catheter with different success rate as in the following table.

Table 2: Success rate of different sclerosing agents

Result	Bleomycin	FFP	Povidone–iodine.
Number	60	30	45
Route of delivery			
Chest tube	41	19	27
Pigtail catheter	19	11	18
Success	51 85%	27 90%	32 71.1%
Failure	9 15%	3 10%	13 28.95%

The complications that occurred in different groups are explained in the following table.

Table 3: Complications occurred in different groups

Complication	Bleomycin	FFP	Povidone–iodine
Number	60	30	45
Pain	4 6.6%	2 6%	14 31.1%
Hypotension	2 3.3%	4 13%	10 22.22%
Empyema	2??% 3.3%	1??% 3.33%	1??% 2.22%
Chest wall sinus	0	0	0

DISCUSSION

A diverse range of sclerosing agents are available, including talc, antibiotics (such as doxycycline), immunomodulators, caustic chemicals, nitrates, and even biological agents. Practically, we must identify the optimal agent based on both cost and efficacy⁽⁶⁾. The current study looked a safe, effective, and inexpensive way to treat pleural effusions that come back. The results and complication rates of bleomycin and FFP were similar in this trial. However, compared to Povidone–iodine, there was a statistically significant reduction in general complications with FFP, and the success rate and were both improved.

Kahromet *al.*⁽⁷⁾ study revealed that regarding the effectiveness of povidone–iodine in pleurodesis, the success rate was 82.2%, which is more than our result and occurrence of pain was in about 27% of their cases.

Elayouty *et al.*⁽⁸⁾ study compared between result of pleurodesis with bleomycin versus povidone iodine. The success rate of bleomycin was 89%, near to our study result but in povidone iodine it was 88%, which is more than success rate in our study. Pain occurred in 53% of patient with bleomycin, and 68% in patient with povidone iodine that was more than our study. This may be due to usage of lignocaine with sclerosing agent during intra pleural injection.

Also **Shouman *et al.***⁽⁹⁾ study demonstrated the result of many sclerosing agent as tetracycline, talc slurry, povidone iodine, and bleomycin, the result of success rates was 80%, 80%, 66.6%, and 73.3% respectively, which is slightly near to our result in bleomycin and povidone iodine.

Saleh *et al.*⁽¹⁰⁾ found that different sclerosing agents as bleomycin, doxycycline and povidone–iodine solution can be utilized for pleurodesis in recurrent malignant pleural effusion without significant difference between them and the priority was according to the availability and patient tolerance.

Mager *et al.*⁽¹¹⁾ study revealed the effect of rolling movement of the patient after injection of sclerosing agent, as we do usually, on the result of success and they demonstrated no significant influence. They recommended discontinuing this maneuver to make the practice simpler. This may be due to the pleural space is a potential space and the sclerosing agent would be spread all over the space during respiratory movements.

The effect of route of administration of sclerosing agent, either through chest tube or small catheter, on the results of pleurodesis success and recurrence of effusion was investigated in **Clements *et al.***⁽¹²⁻¹⁶⁾ study, that found no significant difference, as in our study. But the larger tubes resulted in more discomfort to the patient.

CONCLUSION

Pleurodesis is a safe technique for malignant and non-malignant pleural effusion, and FFP is a good

alternative sclerosing agent to bleomycin and it is safe, available and less costly.

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