Pleurodesis: A Comparision of Two Sclerosing Agents for Pleural Effusion

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ABSTRACT

Introduction: Pleural effusion is one of the most frequently encountered pathology in our hospital. Thoracocentesis, thoracostomy, pleurodesis is the most commonly used treatment options for recurrent and persistent pleural effusion. Sterile talc powder is most commonly used as an sclerosing agent. In our study we have used sodium tetradecyl sulfate as a newer sclerosing agent and we have compared the complication rate, clinical response and success rate in both sodium tetradecyl sulfate and talc sclerosing agent for pleurodesis. Study aimed to compare the safety and efficacy of the sodium tetradecyl sulfate and talc as a pleurodesis agent in pleural effusion cases.

Material and methods: Pleural effusion cases (both malignant and non-malignant cases) were randomly allocated into group A or group B. Group A patients were treated with 60mg of 3% sodium tetradecyl sulfate, Group B patients were treated with 2 grams of sterile talc powder. Clinical data regarding general complications, the rate of success, reduction in ICD drainage and lung expansion were noted for every patient who underwent pleurodesis.

Results: 25 patients were allocated in each group. Patients characteristics were balanced between the two groups with the majority of pleural effusion malignant in etiology. There is a statistically significant difference between the use of sodium tetradecyl sulfate and talc in clinical response, ICD drainage and lung re-expansion. Sodium tetradecyl sulfate patient has better lung reexpansion and clinical response in comparison to talc powder. The general complication was observed to be low with sodium tetradecyl sulfate than talc pleurodesis.

Conclusion: Sodium tetradecyl sulfate pleurodesis appears to have better pleurodesis effect than talc pleurodesis in our study.

Keywords: Pleural Effusion, Pleurodesis, Talc, Sodium Tetradecyl Sulfate

INTRODUCTION

Pleural effusion constitutes one of the most frequent pathologies encountered. Most of these are malignant pleural effusion. Majority of these recur after simple thoracentesis within 5-10 days. Repeated thoracocentesis in these cases is not recommended as the process can increase the risk of metastasis spread at the site of the puncture, pneumothorax, empyema, and loss of protein.[1,2] The resulting protein depletion leads to a decrease in oncotic pressure and consequent new accumulation of fluid in the pleural space.[1] In this situation, patients present with shortness of breath that interferes with their quality of life. Placement of a pleural drainage tube and instillation of sclerosing agents in the pleural space is the preferred approach for these recurrent effusions.[3-5]

Pleurodesis aims to provoke an inflammatory process within the visceral and parietal pleura that will fibrose and adhere both layers together thereby preventing reaccumulation of fluid.[6,7] The mechanism of pleurodesis at the cellular and molecular level involves substantial and widespread irritation of the mesothelium that causes recruitment of fibroblasts with subsequent deposition of collagen in the pleural space and activation of the coagulation cascade and inhibition of fibrinolytic activity in the pleural space.

In our center we commonly use sterile talc powder as a sclerosing agent. In this prospective randomized control study we have used sodium tetradecyl sulfate as a newer sclerosing agent for pleurodesis and we have compared the efficacy and safety of both these agent for pleurodesis in recurrent pleural effusion cases. Study aimed to compare the safety and efficacy of the sodium tetradecyl sulfate and talc as a pleurodesis agent in pleural effusion cases.

MATERIAL AND METHODS

Recurrent pleural effusion cases were randomly allocated into Group A and Group B. Group A patients were treated with sodium tetradecyl sulfate, Group B patients were treated with sterile talc powder. 25 patients in each group was taken. Clinical data regarding general complications, the rate of success, ICD drainage and lung expansion were noted for every patient.

Inclusion criteria: Patients of all age group with recurrent pleural effusion (malignant or benign) of moderate to the large volume which provided informed consent for pleurodesis.

Exclusion criteria: Patients with endobronchial obstruction,

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pleural thickening with trapped lung, destroyed lung.

Pleurodesis Technique: Posteroanterior and lateral chest X rays were performed prior to the introduction of the chest tube. Tube thoracostomy was performed in the mid-axillary line 5 or 6th intercostal space with a connection to an underwater seal. The drainage tube was continued for 48hrs or until the drainage stops or did not exceed 50-100ml/day with subsequent lung expansion. Repeat chest X-ray assessed for removal of all the liquid and lung expansion. Sclerosing agent (60mg of 3% sodium tetradecyl sulfate for Group A patients, 2 grams of sterile talc powder for group B patients) was injected through the tube followed by injection of 20ml of normal saline after which the tube was clamped. The patient changed position during the following 4-6 hrs after which the tube was unclamped and attached to the drainage system with active drainage until the volume of liquid drained did not exceed 50ml/day. If the repeat chest X-ray demonstrated lung re-expansion and absence of pleural effusion the drainage tube was removed. If the pleural effusion was present, the drainage tube was continued for an additional 24hrs. Pleurodesis was repeated using the same sclerosing agent if after 48hrs the drainage exceeded 200ml. No intrapleural anesthesia during pleurodesis or anti-inflammatory medications, steroids during or 1-week post procedure were used.

In cases where the initial pleurodesis for malignant pleural effusion failed, the following alternatives were considered: repeat pleurodesis, repeat therapeutic thoracocentesis, pleurectomy several months following initial pleurodesis.[8]

We defined clinical success rate as an effective expansion of the lung to the chest wall (100% efficiency) confirmed by physical exam, radiographic resolution combined with numbers of pleurodesis required to achieve symptomatic relief.[8] The partial success rate was defined by clinical signs and chest X-ray that indicates the presence of residual pleural fluid, < 50% of the initial radiograph. Recurrent effusions are defined by the reappearance of pleural fluid within 1 week after the first thoracocentesis.

STATISTICAL ANALYSIS

Frequencies and proportions for baseline characteristics and clinical outcomes were reported. Frequencies of clinical outcomes and complications for each treatment group were compared using Fisher's exact test and P values are reported. Significant testing was done using a two-tailed alpha level of 0.05. All analysis was done using SAS Studio statistical software, version 3.6

RESULTS

A total of 50 patient were included in the study, of which for 25 patients sodium tetradecyl sulfate was used and for another 25 patients sterile talc powder was used randomly. Patients characteristics were balanced between the 2 groups and the majority of the pleural effusions were malignant in origin.

Among 25 patients in each group, in STS group (44% male and 56% female) in the talc group (60% male and 40%

Gender Distribution	STS	TALC
Male	11 (44%)	15 (60%)
Female	14 (56%)	10 (40%)

Table-1: Gender Distribution

AGE (years)	STS	TALC
10-30	4 (16%)	1 (4%)
31-60	18 (72%)	5 (20%)
>60	3 (12%)	19 (76%)

Table-2: Age Distribution

Score	STS	TALC
1	7 (28%)	3 (12%)
2	12 (48%)	16 (64%)
3	5 (20%)	5 (20%)
4	1 (4%)	1 (4%)

Table-3: Performance status [ECOG- Eastern Cooperative Oncology Group]

Type of effusion	STS		TALC	
Malignant				
Carcinoma breast	7	28%	8	32%
Carcinoma lung	2	8%	4	16%
Carcinoma ovary	3	12%	2	8%
Carcinoma stomach	2	8%	2	8%
Prostate carcinoma	1	4%	2	8%
Lymphoma	2	8%	1	4%
Non malignant (tb effusion)	8	32%	6	24%

Table-4: Type of effusion

Symptoms	STS	TALC	P value
Fever	0	2	0.5
Nausea	0	0	n/a
Cough	2	9	0.037
Shortness of breath	15	20	0.21

Table-5: Systemic symptoms

Pain	STS	TALC	P value
Yes	1	4	0.34
No	24	21	

Table-6: Local symptoms

Clinical response	STS	TALC	P value
Partial	4	14	0.007
Total	21	11	

Table-7: Clinical response

ICD drainage & lung expansion	STS	TALC	P value
Partial (ICD >50ml/day)	3	17	<0.0001
Total (ICD <50ml/day)	22	8	

Table-8: ICD drainage and lung expansion

	STS	TALC	P value
Repeated pleurodesis	3	10	0.05
No repeated pleurodesis	22	15	

Table-9: Repeated pleurodesis

female) (table-1).

Among 25 patients in each group, in the STS group 16% belongs to age between 10-30 years, 18% between 31-60 years, 12% of them for more than 60 years. In the talc group 4% of them belongs to 10-30 years, 20% between 31-60 years, 76% of them for more than 60 years (table-2).

Among 25 patients in each group, in STS group 28% with performance status 1, 48% -2, 20%-3, 4%-4. In talc group 12% with performance status 1, 64%-2, 20%-3, 4%-4 (table-3).

Among 25 patients in each group, in STS group 68% of patients have malignant pleural effusion, 32% of them having non-malignant (TB pleural effusion). In the talc group 76% of patients having malignant pleural effusion, 24% of them having non-malignant (TB pleural effusion) (table-4).

Systemic symptoms such as fever, nausea, cough, shortness of breath were compared between the STS group and the talc group. There was a statistical difference between two in cough with a p-value of 0.037 (table-5).

The local symptom of occurrence of pain in the chest was compared and it was statistically insignificant p-value of 0.34 (table-6).

Clinical response as there is an improvement in dyspnoea and chest pain was better with the use of sodium tetradecyl sulfate than the usage of talc with a p-value of 0.007 (table-7).

ICD drainage and Lung re-expansion rate was also better with the usage of sodium tetradecyl sulfate in comparison to talc pleurodesis with the p-value of 0.0001 (table-8).

Repeated pleurodesis was less with STS (3 patients) in comparison to talc (10 patients), but it was statistically insignificant (p =0.05) (table-9).

DISCUSSION

When the pleural effusion has been documented to be malignant or paramalignant and the patient is not a surgical candidate, the clinician must make a decision concerning palliation. Various palliative methods are based on the extent of malignant disease, performance status, and the biochemical characteristics of the fluid. These include therapeutic thoracocentesis periodically, place an indwelling catheter on an outpatient basis, tube thoracostomy, medical thoracoscopy or video-assisted thoracic surgery with pleurodesis, pleural abrasion, pleurectomy. For most patients, the most cost-effective and least morbid method for controlling symptomatic recurrent pleural effusion is chest tube drainage with instillation of sclerosing agents.

There are a wide variety of sclerosing agents available which include talc, antibiotics (tetracycline, minocycline, doxycycline), cytostatic agents (bleomycin), antimalarials (quinacrine, mepacrine), 50% glucose in water, immunomodulators, caustic substances, nitrates and biological agents. These agents provoke an inflammatory process within the visceral and parietal pleura that will fibrose and adhere both pleural layers together thereby preventing reaccumulation of pleural fluid.

In our study we have used sodium tetradecyl sulfate as a newer sclerosing agent. sodium tetradecyl sulfate is commonly used for the treatment of varicose vein and esophageal varices. It is a detergent (0.5-3%), interfere with cell surface lipids. It changes the surface tension of the plasma membrane of mesothelial cells and induces inflammatory reactions, thereby leading to fibrosis between the parietal and visceral pleura.[9]

Talc is also a commonly used sclerosing agent for pleurodesis. It produces symphysis between the visceral and parietal pleura. That prevents the accumulation of liquid in the pleural space. Talc also has local antitumor effect by triggering apoptosis in the cancer cells and by altering the angiostatic balance via endostosis.[10,11]

CONCLUSION

3% Sodium tetradecyl sulfate appears to be better sclerosing agent compared to sterile talc in terms of clinical response and lung re-expansion in cases of recurrent pleural effusion cases. Even though the sodium tetradecyl sulfate is costlier than talc.

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