

ORIGINAL ARTICLE

Chemical Pleurodesis for Secondary Spontaneous Pneumothorax – A Comparative Study between Talc and Tetracycline Pleurodesis

Md. Nazmul Islam¹, Mohammad Kamrul Islam², GM Akbar Chowdhury³,
Md. Mofizur Rahman Mia⁴, Kazi Saiful Islam⁵, Zahidul Islam⁶, Md. Mobarak Ali⁷

Abstract:

Background: Secondary spontaneous pneumothorax is a significant problem in the area of management of the chest diseases. An estimated recurrence rate of primary/secondary spontaneous pneumothorax is about 23-50% after the first episode and higher after the first recurrence. (Tschopp, 1997)¹

Early interest in the development of pleural symphysis resulted from the desire of surgeons to produce adhesions between visceral and parietal pleura. To achieve this desire, various agents (such as- silver nitrate, tetracycline, talc, bleomycine fibrin glue etc.) were tried but were found to be of limited value. The indications for pleurodesis have expanded over the years to include the treatment in prevention of recurrence of pneumothoraces. More recently, it is also used to assist in the closure of persistent bronchopleural fistula and the treatment of benign and malignant pleural effusion. (Kennedy and Sahn, 1994)². Because of its excellent record of successful pleurodesis and low cost, talc has received substantial attention recently. The purpose of this study is to review the chemical properties, efficacy and safety of talc as a pleurodesis agent.

Objective: To compare the efficacy of the talc pleurodesis and tetracycline pleurodesis for the treatment of secondary spontaneous pneumothorax, find out a standard and cost effective treatment for better outcome, complications following instillation and length of hospital stay.

Methods: Since January 2012 to December 2013, 60 patients meeting the enrolled criteria were included. Patients were divided into two groups – Group A: Talc pleurodesis & Group B: tetracycline Pleurodesis. Selective variables were studied. Statistical analysis of the results was obtained by using SPSS-16. The result was presented in tables & diagrams.

Result: Chemical pleurodesis with talc is effective and reduces the hospital stay & cost of patient suffering from secondary spontaneous pneumothorax.

Conclusion: Chemical Pleurodesis with talc and tetracycline are equally effective in clinical aspects for the management of secondary spontaneous pneumothorax. But talc pleurodesis reduces hospital stay & cost during management of secondary spontaneous pneumothorax.

Keywords: Pleurodesis, Secondary Pneumothorax, Talc.

[Chest & Heart Journal 2016; 40(1) : 42-48]

1. Assistant Professor, Thoracic Surgery, National Institute of Diseases of Chest & Hospital (NIDCH), Dhaka
2. Associate Professor, Thoracic Surgery, NIDCH, Mohakhali, Dhaka
3. Professor, Thoracic Surgery, NIDCH, Mohakhali, Dhaka
4. Associate Professor, Thoracic Surgery, NIDCH, Mohakhali, Dhaka
5. Associate Professor, Thoracic Surgery, NIDCH, Mohakhali, Dhaka
6. Registrar, Thoracic Surgery, NIDCH, Mohakhali, Dhaka
7. Associate Professor, Radiology & Imaging, NIDCH, Mohakhali, Dhaka
8. **Correspondence to:** Dr. MD. Nazmul Islam, Assistant Professor, Thoracic Surgery, NIDCH, Mohakhali, Dhaka

Introduction:

Pneumothorax is a condition where there is accumulation of air within the pleural cavity with secondary lung collapse. Source of air in the pleural space are rupture of visceral pleura with secondary air leak from lung, loss of integrity of the parietal pleura (e.g; trauma), loss of integrity of the mediastinal pleura, rarely by gas forming organisms etc.

A spontaneous pneumothorax is either primary or secondary and occurs because of parenchymal lung disruption. Primary spontaneous pneumothorax arise in healthy people without any pre-existing lung disease. Secondary pneumothorax arise in subjects with underlying lung disease and recur (Almind, et al., 1989)³. The choice of treatment is influenced by the size of the pneumothorax, clinical symptoms, local practices, technical possibilities and the presumed recurrence rate (Almind, et al., 1989). Spontaneous pneumothorax is a frequent management problem for the chest physicians and thoracic surgeons in our country.

Pleurodesis is a procedure to obliterate the pleural spaces by apposition of visceral & parietal pleura by initiating a sterile inflammation. This procedure prevents recurrence of pneumothorax. This procedure is commonly accomplished by removing air from the pleural space when present, followed by either a mechanical procedure (i.g; abrasion or partial pleurectomy) or instillation of a chemical irritant into the pleural space which causes inflammation and fibrosis.

At the present time, the most popular pleurodesis agents are talc all over the world. The reason for this popularity of talc are that its instillation procedure either in a suspension (slurry) or by insufflation, effective, inexpensive, widely available and associated with minimal side effects in most reports (Light, 2002)⁴. In case of the spontaneous pneumothorax, the success rate of the recurrence prevention by talc is 91% and approximately 67% for tetracycline, which is mostly used procedure in our country now a days (Sahn, 2000)⁵.

Materials & Methods:

Place of study: The study was conducted in the Department of Thoracic Surgery, National Institute of Diseases of the Chest and Hospital,

Dhaka.

Study design :It was a prospective, randomized, single blinded, controlled trial .

Period of study: The study was conducted between the periods of January 2012 to December 2013.

Study population: All secondary spontaneous pneumothorax patients in NIDCH, Mohakhali, Dhaka. As NIDCH is the only referral centre in Bangladesh and patients are coming from every corner of the country, the patient selected from NIDCH represent to some extent the whole Bangladesh.

Sample size: A total of 60 cases of secondary spontaneous pneumothorax were taken and they were divided in two groups, one for group A (i.e; talc pleurodesis) and another for group B (i.e; tetracycline pleurodesis).

Selection of sample:

Sample was selected from the inpatient department of NIDCH of either sex.

a) Inclusion criteria:

i Patients who are admitted in NIDCH and diagnosed as secondary spontaneous pneumothorax of different aetiology with tube thoracostomy.

ii Should have radiological and clinical evidence of complete expansion of underlying lung after tube thoracostomy.

b) Exclusion Criteria:

- i. Patients with incomplete expansion of underlying lung.
- ii. Patients with broncho-pleural fistula.
- iii. Empyema thoracis
- iv. History of previous chemical pleurodesis.
- v. Patients who are not willing to be included in the study.

Randomization of the Patients: Was done by lottery method.

Talc Slurry Pleurosis:

- I. When lung became completely expanded.
- II. Then we introduced injection 1% lignocaine 20 ml or 2% lignocaine 10 ml diluted with 10 ml normal saline and introduced through the IT tube.

- III. Tube was clamped and waited for 15 minutes for local anesthesia.
- IV. Then a 5gm dose of talc was mixed with sterile saline solution of 50ml in a 50 cc. syringe to create a "slurry". The drain was clamped and the syringe was connected to the drain. The slurry was injected and the drain was re-clamped.
- V. Then the patient would be placed in a series of positions by the nursing staff one side first, then the other, with the head up followed by head down- each position for 10 minutes. This distributed the talc slurry over the surface of the lung and the ribs.
- VI. After an hour or so the drain became unclamped to allow excess talc and saline to drain out. The drain is usually removed the following day after a check x-ray of the chest to get information about air leak, reexpansion of the affected lung.

Tetracycline pleurodesis:

- I. Tetracycline pleurodesis done when lung was expanded. All air was came out.
- II. Then we introduced injection 1% lignocaine 20 ml or 2% lignocaine 10 ml diluted with 10 ml normal saline and introduced through the IT tube.
- III. Tube was clamped and waited for 15 minutes for local anaesthesia.
- IV. Then we introduced injection tetracycline hydrochloride at a dose of 35 mg/kg body weight.
- V. Finally 20 ml normal saline is introduced to flush the tube.
- VI. The IT tube is clamped for 6-8 hrs and advised the patient to change his posture hourly.
- VII. Unclamped the tube after 6-8 hrs and allowed drainage.

Measures of variables :

1. Demographic variables: Age, Sex, Weight (in kg).
2. Presence of risk-factors :Diabetes,Mellitus,HeartFailure,Smoking.

3. Variables related to disease:
 - i. Cause of secondary spontaneous pneumothorax.
 - ii. Pre-pleurodesis complaints :Chest pain, Cough, Fever, Dyspnoea
4. Immediate post pleurodesis side effect: Pain, Fever,Dyspnoea .
5. Post pleurodesis complications : Wound infection , ARDS
6. Post pleurodesis death
7. Post pleurodesis X-ray findings
8. Duration of IT tube remained
9. Total hospital stays

Statistical analysis of data:

Statistical analysis of the results was obtained by using window based computer software devised with Statistical Packages for Social Sciences (SPSS-16) (SPSS Inc., Chicago, IL, USA). The results were presented in tables and diagrams. During analysis frequency distribution for all the variables were worked out and produced in tabular form. ?2 tests and unpaired 't' was used to compare proportions. A two-sided p value 0.05 will be considered significant at 95% level.

Result:

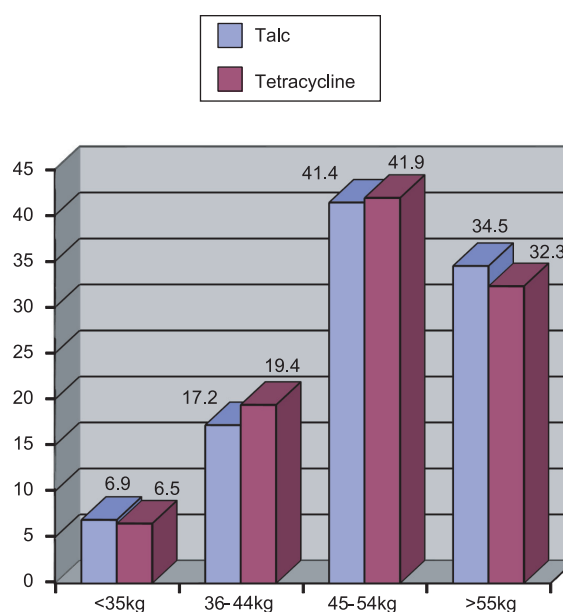


Fig.-1: Distribution of weight of the patients by groups.

Table-I
Distribution of risk factors by groups

Causes of secondary spontaneous pneumothorax	Groups		p value [#]
	Talc n=29	Tetracyclinen=31	
COPD	28 (96.6)	28 (90.3)	0.334
Tuberculosis	01 (3.4)	03(9.7)	
Total	29(100.0)	31 (100.0)	

Table-II
Distribution of causes of secondary spontaneous pneumothorax

Causes of secondary spontaneous pneumothorax	Groups		p value [#]
	Talc n=29	Tetracyclinen=31	
COPD	28 (96.6)	28 (90.3)	0.334
Tuberculosis	01 (3.4)	03(9.7)	
Total	29(100.0)	31 (100.0)	

Table-III
Distribution of pre pleurodesis complaints by groups

Pre pleurodesis complaints	Groups		p value [#]
	Talc n=29	Tetracyclinen=31	
Chest pain			0.640
Present	23 (79.3)	23 (74.2)	
Absent	06 (20.7)	08 (25.8)	
Cough			0.088
Present	20 (69.0)	27 (87.1)	
Absent	09 (31.0)	04 (12.9)	
Fever			0.152
Present	04 (13.8)	09 (29.0)	
Absent	25 (86.2)	22 (71.0)	
Dyspnoea			
Present	29(100.0)	29(00)	
Absent	00(00)	00(00)	

Table-III
Distribution of immediate post pleurodesis complaints by groups:

Post pleurodesis complications	Groups		p value [#]
	Talc n=29	Tetracycline n=31	
Wound Infection			0.164
Present	00 (00)	2 (6.5)	
Absent	29 (100)	29 (93.5)	
ARDS			0.137
Present	02 (6.9)	00 (00.0)	
Absent	27 (93.1)	31 (100.0)	
Death			0.514
Present	2 (6.9)	1 (3.2)	
Absent	27 (31.0)	30 (96.8)	

Table-IV
Distribution of X-ray findings before discharge:

Post pleurodesis X-ray findings	Groups		p value [#]
	Talc n=29	Tetracycline n=31	
Expanded	27(93.1)	30 (96.8)	0.514
Not expanded	2 (6.9)	1 (3.2)	
Total	29 (100.0)	31 (100.0)	

Table-V
Distribution of Duration of IT tube by groups

Duration of IT tube remained	Groups		p value [#]
	Talc n=29	Tetracycline n=31	
< 5 days	26(88.4)	19(61.29)	0.022*
6-10 days	01(3.4)	09(29.03)	
> 10 days	02(6.8)	03(9.67)	
Total	29(100.00)	31(100.00)	
Mean \pm SD	2.37 \pm 3.46	5.22 \pm 4.09	

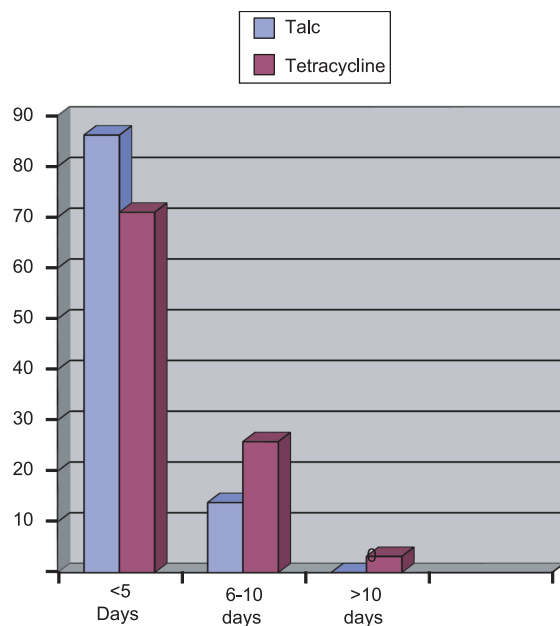


Fig.-3: *Distribution of hospital stay of the patients by groups*

Table-VI
Distribution of hospital stay (days) by groups

Hospital stay (days)	Groups		p value [#]
	Talc n=29	Tetracycline n=31	
Mean \pm SD	3.27 \pm 2.03	4.93 \pm 2.22	0.004*

Discussion:

In the present study out of 29 patients in talc group about half of the patients of the talc group were in age group of 41 to 50 (44.8%) years followed by 31 to 40 years (24.1%). Five (17.2%) patients were in the age group of 61 to 70, Three (10.3%) patients were 51 to 60 and one (3.4%) patient was less than 30 years. Out of 31 patients in tetracycline group highest number of patients was in the age group of 41 to 50 years (38.7%) followed by 61 to 70 years age group (29.0%). Five (16.1%) patients of the tetracycline group were in the age group of 31 to 40 years and four (12.9%) patients of the tetracycline group were in the age group of 51 to 60 years and rest 1 (3.2%) were in the age group of more than 70 years. Mean \pm SD of age of the talc group and tetracycline group were 47.48 ± 11.26 years and 53.52 ± 12.61 years respectively (Table-1). There is no statistically significant difference in the age between the groups ($p > 0.05$). In the present study the age range of patients were 29-80 years. Almind, et al., 1989 in a study of ninety-six patients of spontaneous pneumothorax found the age range of 18-88 years. (Almind, et al., 1989)

In the present study out of 29 patients in the talc group 28 patients (96.6%) had COPD and one patient (3.4%) had pulmonary tuberculosis. Out of 31 patients in tetracycline group 28(90.3%) patients had COPD and 3(9.7%) patients had pulmonary

tuberculosis. There is no statistically significant difference in the groups ($p>0.05$).

The clinical symptoms associated with secondary pneumothoraces are more severe than those associated with primary pneumothoraces, and most patients with a secondary pneumothorax complain of breathlessness which is out of proportion to the size of the pneumothorax. (Henry, Arnold and Harvey, 2003)⁶ Chest pain, cough, and fever are most often found in secondary spontaneous pneumothorax patients with underlying pulmonary tuberculosis than in secondary spontaneous pneumothorax patients without tuberculosis. (Michael, 2000) In the present study pre-pleurodesis complaints by groups were evaluated. Most of the patients in the present study were presented with typical symptoms associated with secondary spontaneous pneumothorax include dyspnea, cough and chest pain. In the present study out of 29 patients in the talc group, all the patients (100.0%) were presented with dyspnoea, followed by chest pain (79.3%) and cough (69.0%). Four (13.8%) patients in this group presented with fever. In tetracycline group all the patients (100.0%) were presented with dyspnoea, followed by cough (87.1%) and chest pain (74.2%). Nine (29.0%) patients in this group were presented with fever. There is no statistically significant difference in pre pleurodesis complaints of dyspnoea, cough, chest pain and fever between the groups ($p>0.05$).

In the talc group post pleurodesis complaints of local pain, fever and dyspnoea were present in 100%, 82.8% and 62.1% respectively. In tetracycline group post pleurodesis complaints of local pain and dyspnoea were present in 96.8% and 93.5% respectively and 87.1% patients in the tetracycline group were presented with post pleurodesis fever (Table 7). There is no statistically significant difference in post pleurodesis complaints of local pain and fever between the groups ($p>0.05$) but statistically significant difference observed in post pleurodesis complaint of dyspnoea between the groups ($p<0.05$). The local pain, dyspnoea and fever were easily controlled with routine medications. Chest pain and fever are the most common adverse effects of all pleurodesis agents (Sahn, 2000). Well-documented complaints of talc pleurodesis are fever (16-69%) and chest pain (7%). But Milanez et al., 1994 found that local pain associated with talc

pleurodesis is less than that associated with tetracycline pleurodesis. (Milanez et al., 1994)⁷.

In the present study out of 29 patients in talc group In talc group post pleurodesis complications of wound infection, ARDS and death were present in 00%, 6.9%, and 6.9% respectively. In tetracycline group post pleurodesis side effects of wound infection, ARDS and death were present in 6.5%, 00% and 3.2% respectively. There is no statistically significant difference in post pleurodesis complications of wound infection, ARDS and death between the groups ($p>0.05$) In case of ARDS, we tried to manage according to ARDS management protocol. After intrapleural administration as slurry or insufflation, serious pulmonary complications, including acute pneumonitis, acute respiratory failure and ARDS with different incidences ranging between 0% and 33% have been reported (Gozubuyuk et al., 2010⁸; Andres et al., 2000⁹).

The incidence of ARDS has varied markedly from series to series. The mechanism by which talc produces acute lung injury is unknown. (Light, 2000). A possible cause of the lung injury is a systemic inflammatory response secondary to extra-pleural dissemination of talc, the severity of which is dependent on the particle size and the dose used for the procedure. Aetiology of ARDS is thought to be related to dose and particle size of talc. In the future, the safety of talc for pleurodesis will need close attention (Andres et al., 2000)⁹.

In the present study out of 29 patients in the talc group 27 (93.1%) were expanded and 2 (6.9%) were not expanded. Out of 31 patients in the tetracycline group 30 (96.8%) were expanded and 1 (3.2%) were not expanded. There is no statistically significant difference in X-ray findings before discharge between the groups ($p>0.05$).

From duration of IT tube remained in the present study, out of 29 patients in the talc group highest number 26 (88.4%) patients of the talc group were in 5 days and below group followed by 02 (6.8) patients were in above 10 days. 01 (3.4) patient was within 6 to 10 days group. Highest number 19 (61.29%) patients of the tetracycline group were in 5 days and below group followed by 09 (29.03%) patients were within 6 to 10 days group. 03 (9.67%) patients were in above 10 days group. Mean \pm SD

of duration of IT tube remained of talc group and tetracycline group were 2.37 ± 3.46 days and 5.22 ± 4.09 respectively. There is statistically significant difference in duration of IT tube remained between the groups ($p > 0.05$).

From hospital stay in the present study, out of 29 patients in the talc group highest number 25 (86.2%) of patients of the talc group were within 5 days followed by 6 to 10 days group 4 (13.8%). Highest number 22 (71.0%) of patients in the tetracycline group were within 5 days followed by 6 to 10 days group 8 (25.8%). 1 (3.2%) patients were in above 10 days group. Mean \pm SD of hospital stay of talc group and tetracycline group were 3.27 ± 2.03 days and 4.93 ± 2.22 respectively. There is statistically significant difference in hospital stay between the groups ($p < 0.05$).

Conclusion:

From the present data it may be concluded that chemical pleurodesis with talc and tetracycline are equally effective in clinical aspects for the management of secondary spontaneous pneumothorax. But talc pleurodesis reduces hospital stay and cost during the management of secondary spontaneous pneumothorax.

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