

ORIGINAL ARTICLE

THE EFFECTIVENESS OF SUSTAINED (UNCLAMPED) PLEURODESIS IN SPONTANEOUS PNEUMOTHORAX

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ABSTRACT**OBJECTIVE:**

To determine the safety and effectiveness of sustained (unclamped) pleurodesis in the management of spontaneous pneumothorax.

Material and Methods: This non intervention descriptive study extended over a period of three and a half years from June 2005 to December 2008. Patients with both primary & secondary spontaneous pneumothorax were included while those with recurrent pneumothorax were excluded from the study. Pleurodesis was performed with tetracycline and after instillation of pleurodesing agent, the tube was not clamped.

Results: 51 patients were included in the study of which 35(69 %) were males. Fourteen (27 %) patients smoked cigarettes while rest were non smokers. The immediate adverse effects after instillation of sclerosing agent were pain and fever. Lung remained expanded after pleurodesis in all the patients and none had lung collapsed in 24 hours. There were no major complications in any patient. Total duration of hospital stay was 3 days in 29% of patients, 7 days in 50% while 21 % stayed for more than 7 days. Patients were followed up at 15 days, 30 days and 6 months intervals. Sixty four percent completed all three follow up visits, 18 % completed 2 and 18 % only first visit. The recurrence rate was 5.8%.

Conclusion: Sustained (unclamped) pleurodesis is safe and effective procedure in spontaneous pneumothorax.

KEY WORDS:

Pneumothorax, pleurodesis

INTRODUCTION:

Pneumothorax is presence of air within the pleural cavity¹. There is considerable variation in approach to management of pneumothorax². Basic therapeutic goals are resolution of symptoms by removing air from the pleural space, re-expansion of the lung, and preventive methods to avoid recurrence². To prevent recurrence pleurodesis can be performed by three ways i.e. intrapleural instillation (through a conventional chest tube thoracostomy) of sclerosing chemical agent, surgical intervention via a standard thoracotomy and more recently thoracoscopic surgery and pleurodesis³. The inherent risk associated with surgery has made this mode less favorable choice for pleurodesis than intrapleural instillation⁴. Thoracoscopic surgery however is less invasive but is not available freely in every hospital and is also not cost effective^{4, 5, 6}. Moreover conventional pleurodesis is easy, cheap and safer than surgery^{4, 5}. The procedure of conventional pleurodesis requires the use of clamping of intercostal tube for at least 1 to 3 hours after the instillation of sclerosing agent. However in pneumothorax clamping of the tube is not advisable^{7, 8} due to risk of tension pneumothorax and surgical emphysema³. This is recommended in the British Thoracic Society guidelines for the management of pneumothorax⁹. Based on this we started doing pleurodesis with tetracycline without ever clamping the intercostal tube in order to prevent the lung from going down again. This technique is given the name of "sustained pleurodesis". The term sustained is used because instead of clamping, the tube is hanged in a U shaped manner above the level of patient so that sclerosing agent remains inside the pleura. No local data is available on the safety and efficacy of this technique and very few studies have mentioned use of such technique in the literature^{3, 10, 11}. The aim of this study was to see the safety and effectiveness of "sustained pleurodesis" (unclamped pleurodesis) in patients with fully expanded lung after pneumothorax.

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MATERIAL AND METHODS:

It was non intervention descriptive study. All patients undergoing intercostal tube insertion for spontaneous pneumothorax admitted to Pulmonology Department of PGMI Lady Reading Hospital during the period from June 2005 to December 2008 were studied. Patients with trapped lung, history of previous pleurodesis and recurrent ipsilateral pneumothorax were excluded from study. Clinical and demographic details were recorded for each patient. Following intercostal tube insertion, chest x-ray was performed next day to see expansion of lung, status of underlying lung, drain and air leak were also noted. All the relevant data were entered into a Performa. Sustained i.e. unclamped pleurodesis was performed in those patients whose lung was expanded who were ready for pleurodesis. Only one sclerosing agent i.e. Tetracycline was used in every patients because of its reasonable efficacy, excellent safety profile, ease of administration and low cost.

TECHNIQUE:

Chemical Pleurodesis is carried out using 1 gm of tetracycline in 50 ml of 0.9% Sodium chloride solution. The connection tubing between the chest tube and the drainage bottle is lengthened with a plastic tube approximately 50 cm. The connecting tube is then elevated to 60 cm above the patient and fixed on a hanger. The line between the chest tube, the connection tubing and the drainage bottle becomes an inverted U-shape. (See Fig) The chest tube is not clamped. Because this system allows the air leak and acts as trap for fluid, the sclerosing agent remains inside the pleural cavity so that air can escape from the chest.

At the end of 4 hours, the connection tube is handled as usual. Subsequently, tension pneumothorax is avoided and pleurodesis is carried out effectively.

The procedure was deemed effective when after sustained pleurodesis lung remained expanded after extubation. Patients were followed up at 15 days, 30 days and 6 months intervals. The results obtained were categorized through frequency distribution.

RESULTS:

This study extended over a period of three and a half years from June 2005 to December 2008. 51 patients were included in the study, out of which 35(69 %) were males and 16 (31 %) were females. Fourteen (27 %) patients smoked cigarettes while 37 (73 %) patients were non smokers. The etiology of pneumothorax is given in table 1.

The immediate adverse effects after instillation of sclerosing agent were pain and fever in 12 (23.5%) patients (pain in 8 and fever in all 12). Lung remained expanded after the pleurodesis in all the patients and none had the lung collapsed within 24 hours. There were no major complications in any of the patients.

Total duration of hospital stay was 3 days in 29% of patients, 7 days in 50% while 21 % stayed for more than 7 days.

Regarding follow up, 64 % had completed all three visits, 18 % had completed 2 visits and 18 % had only first visit. The recurrence rate was only 5.8%.

Talbe : EFFECTIVENESS OF SUSTAINED PLEURODESIS ACCORDING TO THE ETIOLOGY OF PNEUMOTHORAX

Etiology of spontaneous Pneumothorax	Number of patients n (%)	Length of hospital stay in days	Follow up Recurrence (n)
Primary Pneumothorax	24 (47%)	4.48	2
SSP due to PTB	14 (58%)	7.5	1
COPD	5 (20%)	6.2	0
Post TB fibrosis & Bronchiectasis	3 (12%)	6.3	0
Interstitial lung disease	1 (4%)	3	0
Coal worker Pneumoconiosis	1(4%)	3	0

DISCUSSION:

Treatment of spontaneous pneumothorax includes observation, pleural drainage, pleurodesis produced by different agents, and thoracotomy either with cyst resection or with pleurodesis induced by brushing the pleural surface, or both². The choice of treatment is influenced by pneumothorax size, clinical symptoms, technical possibilities, and presumed recurrence rate^{2, 12} in the treatment of pneumothoraces, achieving effective pleurodesis is the therapeutic goal². Pleurodesis in pneumothorax is recommended after successful expansion of lung following tube thoracostomy and the aim is to prevent recurrence^{2, 12}. Pleurodesis by conventional methods requires the use of clamping the tube but at the same time clamping is not advisable in case of pneumothorax^{7, 8}. Clamping in pneumothorax can cause tension pneumothorax, surgical emphysema or collapse of tube^{3, 7, 8, 10}. Other school of thought advises to clamp the tube for at least 4-24 hours once lung is fully expanded in pneumothorax. The objective here is to ensure that the lung remains expanded before extubation.

Based on first theory we studied patients with the somewhat different procedure and named it as "Sustained Pleurodesis". This involves elevating the chest tube instead of clamping it, in order to avoid tension pneumothorax and progressive sub cutaneous emphysema^{3, 10}. The rubber tube connecting the chest tube and chest bottle was raised 40 to 60 cm above the patient to trap the tetracycline but allow air to pass underpressure^{2, 9}.

Chemical pleurodesis, Heimlich valve, video assisted thoracoscopic surgery (VATS) and thoracotomy are options available for treating pneumothorax^{3, 4, 7, 8}. In our setup due to the issue of cost and resources, chemical pleurodesis is the commonest used procedure for pneumothorax and malignant pleural effusion^{1, 13, 14, 26}. Various pleurodesing agents viz Tetracycline, Bleomycin, Minocycline, Doxycycline and Talc are used for Pneumothorax^{4, 13, 14}. Due to cost, efficacy and safety^{4, 15, 16, 17, 18, 20} we used Tetracycline as pleurodesing agent. Tetracycline, which was the most widely used agent, reduced the recurrence rate from 41 to 25% in a randomized clinical trial¹⁵. Talc poudrage has the lowest recurrence rate^{23, 24} but it causes granuloma formation and is reserved for malignant effusions. In this study, tetracycline was used for chemical pleurodesis because it can be easily administered, is safe, inexpensive (Rupees 200 to 300 for 1000 mg), and widely available.

This is the first study done in Pakistan, which showed slight predominance of Primary Pneumothorax over Secondary Pneumothorax which is in contrast to other local studies done in Pakistan^{1, 20, 21}. This may be explained by the fact that we excluded patient with recurrent Pneumothorax most of whom were of secondary spontaneous type.

There were no major complications seen with sustained pleurodesis in our study like ARDS, surgical emphysema, tension pneumothorax or immediate recurrence (collapse secondary to recurrence of Pneumothorax). Post pleurodesis, lung remained expanded in all patients and none had collapse in 24 hours. Similar findings were seen in studies done by Almaasi and Hassle¹⁰, though they have used this technique in patients with persistent air leak. Minor adverse effects were pain in 15.5% cases, fever in 23.5 % cases and both pain and fever in 23.5 % patients. Larry W observed same findings in his studies²⁰. Similar side effect profile was seen in other studies done with Tetracycline^{2, 21} and Minocycline, a derivative of Tetracycline¹¹. None of our patients had haemothorax or empyema that was seen in other studies done with minocycline or talc¹⁰. It is believed to be due to the antibiotic action of tetracycline, which might provide some protection against inadvertent contamination of pleural space by the chest tube or any other agent instilled through it²³.

Total duration of hospital stay was 3, 7 and more than 7 days in 29.4%, 50% and 19.6 % of patients respectively which is also comparable to other studies done with Tetracycline and conventional pleurodesis²³.

Hospital stay of more than 7 days in 19.6% patients is somewhat longer than that in other studies by Olsen and Andersen²⁴ and Light et al²⁵. Waiting for the air leaks to close was the main reason for the longer hospital stay in our patients.

In our study, at 6 month follow-up, ipsilateral recurrence was found only in 3 patients (5.8%). Among them two were primary spontaneous pneumothorax and one was secondary to TB. At least one study had shown similar recurrence rate²⁵. Otherwise our recurrence rate of 5.8 percent is somewhat lower than 9 percent reported by Alfageme², 16 percent reported by Olson and Andersen²³ and 25 percent previously reported by Light et al²⁴.

However, recurrence depends on patient selection. In one study, the overall failure rate of this procedure was 19 percent (14/74), including six patients with SP recurrence and eight patients who required surgery, due to persistent air leak².

The estimated recurrence rate is 23 to 50% after the first episode and increases to 80% after the third pneumothorax³. Optimal management of this benign disease has been a matter of debate until recently. The safety and long-term efficacy of preventing recurrence of pneumothorax have never been addressed.

The recurrence of pneumothorax in our study took place after 3 months, a similar observation by Jin -Shing Chen et al¹¹, who used Minocycline, a derivative of Tetracycline. They suggested that the effect of pleural adhesions induced by minocycline may not persist with time. The same phenomenon was also observed in rabbits that early pleural fibrosis induced by minocycline faded gradually after 6 months²². However, the effect of minocycline was still significant in their study because many of the recurrences happened within this period².

CONCLUSION:

Sustained (unclamped) pleurodesis with tetracycline is safe and effective method of pleurodesis and reduces the chances of lung collapse due to clamping of chest tube for pleurodesis.

RECOMMENDATION:

Further randomized trials and comparison of the results with Tetracycline pleurodesis with clamping the tube for Pleurodesis is needed. A long-term follow-up is needed to rigorously test the efficacy of this treatment.

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