

## Effects of Physical Therapy Exercises on Absorption of Pleural Fluid in Patients with Pleural Effusion

**Hafiz Muddassir Riaz\***

*Department of Physical Therapy, University of Health Sciences, Lahore, Pakistan*

**\*Corresponding Author:** Hafiz Muddassir Riaz, Department of Physical Therapy, University of Health Sciences, Lahore, Pakistan.

**E-mail:** muddassir.riaz@gmail.com

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### Abstract

**Introduction:** Pleural effusion is an abnormal collection in the pleural cavity as a result of disproportion in production and reabsorption of pleural fluid or due to an alteration in the drainage. The common types are transudative and exudative pleural effusion.

**Objective:** To evaluate the effect of physical therapy exercises on fluid absorption in patients with pleural effusion.

**Setting:** Department of Pulmonology, Jinnah Hospital Lahore.

**Study Design:** Quasi Experiment study design.

**Patients Size:** 30 patients.

**Method:** Physical therapy exercises were incorporated along with the standard medical treatment. These interventions include segmental breathing exercises, chest expansion, active expiration, thoracic mobility exercises, and diaphragmatic breathing exercises were introduced 3 times per day during the stay in the hospital.

**Results:** Results shows the improvement in the pleural effusion amongst these patients.

**Conclusion:** This study confirms inclusion of physical therapy intervention was helpful in this condition.

**Keywords:** *Pleural Effusion; Physiotherapy; Recovery of Function*

### Introduction

Pleural membrane is a complete close sac that covers the lung surface and internal surface of the thoracic cavity. It has two layers, Parietal pleura and visceral pleura. There are different parts of pleura cervical, costo-vertebral, media-stinal and diaphragmatic.

**Pleural effusion:** Pleural effusion is a collection in pleural cavity, as a result of disproportion in production and reabsorption of pleural fluid, or due to an alteration in the drainage. The common types are transudative and exudative pleural effusion.

There are two types of pleural effusion [1] classified according to the light criteria for pleural effusion.

**Transudative pleural effusion:** An elevated hydrostatic pressure or a reduced capillary pressure causes fluid leaks from blood vessels into the pleural cavity which results in transudative pleural effusion.

**Exudative pleural effusion:** Irritation of the pleura due to pathology of lung and enhancement permissibility in capillaries or change in pleural cavity absorption.

**Light’s criteria [3]**

Transudate vs. exudative pleural effusion		
Characteristic	Transudate	Exudate
Main causes	Increased hydrostatic pressure, Decreased colloid osmotic pressure	Inflammation
Color	Clear	Cloudy
Specific gravity	< 1.012	> 1.020
Protein content	< 25 g/L	> 29 g/L
fluid protein/ serum protein	< 0.5	> 0.5 [7]
Difference of albumin content with blood albumin	> 1.2 g/dL	< 1.2 g/dL
Fluid LDH upper limit for serum	< 0.6 or < 2/3	> 0.6 [6] or > 2/3
Cholesterol content	< 45 mg/dL	> 45 mg/dL

Causes of transudate PE include congestive heart failure, liver failure or cirrhosis, kidney failure or nephritic syndrome and peritoneal dialysis.

Causes of exudate causes include lung or breast cancer, lymphoma, pneumonia, tuberculosis, post pericardiotomy syndrome, systemic lupus erythematosus, kidney failure, Meigs syndrome, pancreatic pseudocyst, ascites, intra-abdominal abscess, and asbestosis and mesothelioma.

A small effusion presents as blunting of the costophrenic angle, the region on CXR between the hemi-diaphragm and the chest wall.

A moderate-sized effusion will presents with the fluid level as horizontal line and there is a meniscus at the point where the fluid touches the chest wall.

In a large pleural effusion, there may be shift of the mediastinum away from the side of the effusion.

It is not easy to estimate all cases as many results in pleural effusion. Pleural effusion from tuberculosis occurs in 5% of sufferer in America. Mostly pleural effusion is treated by dealing with disease. Sometimes sufferer got adhesions which can affect normal physiology of pleura [8].

For prevention of pleural effusion, a healthy life style is important. A well-balanced diet and moderate exercise can help ensure a properly functioning immune system. Pneumococcal pneumonia and influenza may be prevented by vaccination. Patients should be encouraged to stop smoking and to avoid inhaling secondhand smoke. Patients with diseases associated with a risk for pleurisy, such as lupus, rheumatoid arthritis, and tuberculosis, must help to control their disease by being compliant with medications and visits to health care professionals.

**Symptoms:** Breathlessness, cough, chest pain. Breathlessness is common in all and is a sign of worsen condition, even less than 500 ml. There is no significant sign when fluid is volume is lesser than 300 ml, while patients with large pleural effusion presents with pleural rub, decrease chest mobility, vocal fremitus [1].

**Diagnosis:** X-ray of the chest is the first choice of investigation but not always as little effusion is not visible in x-ray film. Use of ultrasound for pleural cavity is common for detection of pleural effusion because it gives more detail about the effusion present in the pleural cavity, or other condition not explained by the chest radiography [1]. In a research it was concluded that ultrasonography helps in making correct diagnosis of pleural effusion for 91% cases which was declared normal on x-ray [14]. CT-Scan is important in examining the regions which are not explained by commonly used radiographs. The size of effusion can be visualized by CT and lung diseases are differentiated from pleural effusion which can help in management [13].

**Medical management:** The backbone of management for pleural effusion is to treat the root cause of the condition. In cases where post-pneumonic emphysema and esophageal rupture is present, absorption from pleural cavity is important. When bacterial infection causes the pleural effusion a relevant drugs therapy is advised. In patients where viral germs are the cause, the condition cure itself but pain stays for many weeks. Steroids are used for the patients with lupus pleural effusion, post cardiac injury syndrome [9].

Pleuritic chest pain is usually managed by analgesics like acetaminophen or non-steroidal anti-inflammatory (NSAID) drugs. Narcotic analgesics may be used for severe pain but may impair the patient's ability to cough. Wrapping the entire chest with elastic bandages may help to relieve severe chest pain but may also increase the risk of pneumonia.

Physiotherapy has great role in the rehabilitation of patient it helps in increasing the confidence of patient that he or she can live an independent life. It also helps to overcome muscular weakness, increase mobility, increase balance and coordination and promote recovery [1].

### Objective of the Study

The study is designed with following objectives: To observe the role of physical therapy exercises in outcome of a patient with pleural effusion coming to Jinnah Hospital Lahore.

### Materials and Methods

#### Subject and study design

This is a quasi experimental study design conducted at Pulmonology Department of Jinnah Hospital Lahore from July to December with population of age from 20 years to onwards with pleural Effusion and sample size of 30 patients was taken without specification of gender. The subjects was divided into 2 groups at convenient basis each group contained 15 subject In experimental group, only medication of the underlying cause is given as per regimen and in other group, Physiotherapy intervention is followed along with the medication of the underlying cause is given as per regimen.

#### Inclusion criteria

1. 20 - 70 years of age.
2. Patient with pleural effusion.
3. Able to understand command and follow the same.
4. Co-operative and ready to share information required during research.

**Exclusion criteria**

The subjects who do not come under above mentioned criteria are not included in the study.

**Data collection procedure**

Patient referred with a self-designed questionnaire, data was collected from the patients admitted in the Department of pulmonology Jinnah Hospital Lahore, and fulfill inclusion criteria will fulfill the study after taking history of patient.

**Data analysis procedure**

For the analysis of data SPSS v.17 used and data is presented in form of tables and appropriate graphs as well as standard deviation and mean is also used for the variables.

**Results**

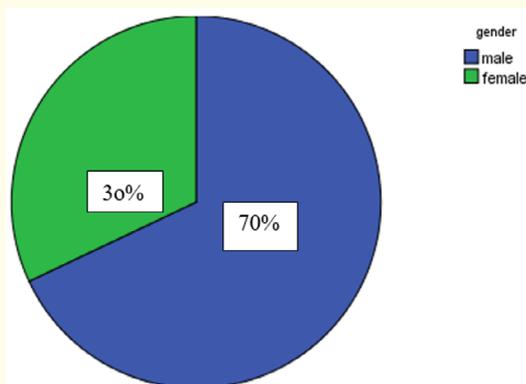
This interventional study was based on 6 months’ time period and 30 patients were involved. A Performa (see annexure) was used for each patient, which was filled out before and after the physical therapy intervention.

**Descriptive statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Group	30	1.00	2.00	1.5000	.50855
Volume BI	30	30.0	497.0	328.633	106.8019
Volume AT	30	33.0	190.0	97.600	53.2784
Valid N (listwise)	30				

In table given above, statistical data of volume of 30 patients is calculated. Mean volume before intervention is 328.633 standard deviation 106.8 and after intervention 97.60 and standard deviation 53.27. Minimum volume of patient after intervention is 33.0 and maximum volume is 190.

**Pie chart**



**Graph 1:** This graph shows the distribution of male and female data.

Case Summaries			
Group		Volume BI	Volume AT
Intervention Group (medication + Physiotherapy)	N	15	15
	Mean	396.400	47.467
	Std. Deviation	112.7905	6.6318
	Minimum	30.0	33.0
	Maximum	497.0	60.0
Control Group (medication Only)	N	15	15
	Mean	260.867	147.733
	Std. Deviation	32.6450	21.2181
	Minimum	220.0	120.0
	Maximum	320.0	190.0
Total	N	30	30
	Mean	328.633	97.600
	Std. Deviation	106.8019	53.2784
	Minimum	30.0	33.0
	Maximum	497.0	190.0

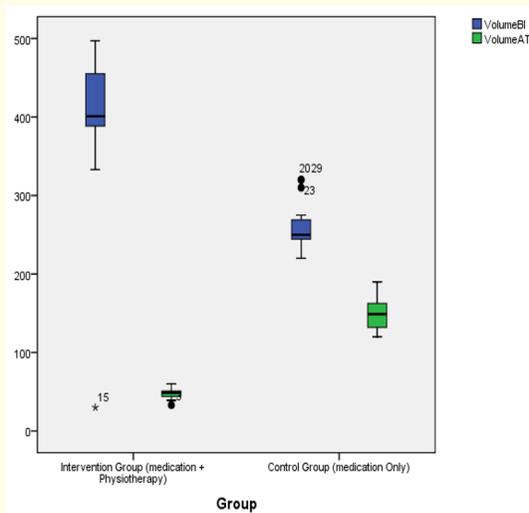
Above table explains the changes in pleural fluid volume at the start and end of intervention. Noticeably larger changes occurs in treatment group (88.1% ± 6.6) than the other (59.9% ± 2.9; p < 0.001) proved that the physical therapy exercises have improved the condition.

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Volume BI	Equal variances assumed	3.103	.089	4.470	28	.000	135.5333	30.3176	73.4305	197.6362
	Equal variances not assumed			4.470	16.329	.000	135.5333	30.3176	71.3680	199.6987
Volume AT	Equal variances assumed	11.974	.002	-17.468	28	.000	-100.2667	5.7399	-112.0242	-88.5091
	Equal variances not assumed			-17.468	16.709	.000	-100.2667	5.7399	-112.3928	-88.1406

Following table explains the corresponding changes at the start and end of the therapy, pleural fluid volume was greatly more in the treatment group (88.15% ± 6.6) than in the control group (59.9% ± 2.9; p < 0.001) which explains the improvement in the pleural effusion.

Five point summary

Diagram shows the data for all cases in 5 number summary.



Figure

Discussion and Conclusion

As drug therapy is the appropriate approach for treating pleural, the inclusion of physical therapy at the beginning of treatment might be helpful, mainly to those patients in which pleural effusion is causing respiratory discomfort. Although Physical therapy is normally considered a hospital-based intervention, its use requires low-cost equipment. Moreover, Physical therapy services are available in outpatient health care units and in home care environments, as well as in hospitals. Additional evaluation is necessary in order to demonstrate its cost-effectiveness. Furthermore, complications associated with the use of non-invasive positive pressure are uncommon. Clinically significant gastric inflation is rare at a pressure of less than 30 cmH<sub>2</sub>O, and aspiration of gastric contents has a very low incidence (5% or less). Local complications such as skin abrasions - due to the contact with the mask - and conjunctivitis are more common (incidence of 15%), yet potentially avoidable and easily treatable. In the present study no adverse effects of CPAP were observed, however this may be due to the small sample size.

The purpose of this study was to recognize the effects of physical therapy intervention in patients with pleural effusion. This study also gives information to society about this disease and its effects. This research explains a meaningful decrease in pleural effusion amongst the experimental group (88.13% ± SD 6.6) during 1 months therapy in comparison with other group (59.9% ± SD 2.9; p < 0.001).

Medical treatment or surgical procedures are usually recommended for the pleural effusion, but the addition of physical therapy may help to improve the condition especially in patients with breathing discomfort.

Physical therapy techniques are used for facilitation of absorption of the fluid, use of abdominal muscles in exhalation in active expiration, increase in the ventilation of the affected lung, chest stabilization and incentive spirometry.

Specific physical therapy intervention includes segmental breathing exercises, chest expansion, active expiration, thoracic mobility exercises, and diaphragmatic breathing exercises.

The pathology of pleural effusion and other factors may also play role in modifying the results. The fibrosis of pleural membrane is important as there may be slow re-absorption of pleural fluid due to increasing fibrosis. So, in patients with chronic disease, the effects of therapy may be not reported or less effective. The comorbidities like cardiac or renal problems are also an important determinant for poor prognosis.

Although the sample was small, but this study demonstrates a debatable result of physical therapy intervention along with the medical treatment. More work with big sample size to explore the efficacy of physical therapy may establish the role of physical therapy and particular techniques.

### Limitations of the Study

A possible study limitation is the fact that medical treatment in outdoor patients is given under direct vision, however, as both groups were monitored regarding drug ingestion and as they did not present with well-known risk factors for treatment default (addiction to drugs, psychiatric disease, previous anti-TB treatment default), this fact likely did not influence our results. Moreover, an exclusion criterion was the interruption of medical medication for more than 2 days.

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