

Effect of Conventional Transcutaneous Electrical Nerve Stimulation (TENS) at Intercostal Chest Drain (ICD) Site in Patients with Pleural Effusion on Pain, Dyspnea and Chest Expansion

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ABSTRACT

Background: Pleural effusion is excessive accumulation of fluid in the pleural space and is generally caused due to underlying medical condition. Managing pleural effusion includes medical management and also pleural fluid drainage by thoracentesis or chest drains. Intercostal Chest drains (ICD) are painful as the parietal pleura are very sensitive to pain. Hypoventilation occurs because of pain and muscle guarding at ICD site. Therefore, it is important to emphasize on pain relief and expansion.

Purpose: The purpose of this study was to find additional effect of (TENS) at ICD site combined with traditional physiotherapy on pain, Dyspnea and Chest expansion in pleural effusion patients.

Methods: The randomized control trial included 40 participants diagnosed with pleural effusion and with chest drain inserted. The participants were randomly allocated into Control group (receiving Traditional physiotherapy) and Experimental group (receiving Conventional TENS at ICD site with two electrodes in addition to Traditional physiotherapy) once a day for 5 days. After allocation baseline measures of pain and dyspnea on 10 point Visual analogue scale (VAS) and chest expansion at 4th intercostal space with centimeter tape were taken.

Results: The results of the study showed that there was significant improvement in TENS plus traditional therapy group on pain ($p < 0.001$), dyspnea ($p < 0.001$) and chest expansion ($p < 0.001$).

Conclusion: Study concludes that TENS when used in combination with traditional physiotherapy shows better results while treating pain, dyspnea and chest expansion in patients with pleural effusion managed by chest drains.

Keywords: Pleural effusion, Intercostal chest drains, pain, dyspnea, Chest expansion, TENS

INTRODUCTION

Pleural effusion is excessive accumulation of fluid in the pleural space and is generally caused due to underlying medical condition. The pleural space is normally filled with 5 to 10 mL of serous fluid, mainly secreted from the parietal pleura at a rate of 0.01 mL/kg/h and through

the lymphatics gets absorbed. [1,2] When the balance between the secretion and absorption is affected in certain conditions, the fluid starts accumulating in the pleural space. This is associated with symptoms of pleurisy viz. chest pain, dyspnea, non-productive cough and fever. [3]

In many parts of the world pleural effusion constitutes as one of the major cause of morbidity. It often presents as a diagnostic problem because of the various etiologies that can cause pleural effusion, even after extensive investigations. Of the diseases affecting the respiratory system, about close to 30% are estimated to involve the pleura. [4] Managing pleural effusions include medical management and also pleural fluid drainage by thoracentesis or chest drains. Intercostal Chest drains (ICD) are painful as the parietal pleura is very sensitive to pain. [5,6] This pain causes muscle guarding at ICD site leading to hypoventilation. Therefore, it is important to emphasize on pain relief and expansion. [7] In a large cohort study of 266,000 Medicare managed care patients surveyed in 2010 and 2012 and it was found that pain and dyspnea commonly occurred, developed and resolved together. [8]

Respiratory Physiotherapy is an important approach that improves lung function. The most common impairments related to pleural effusion include dyspnea, localized pain at ICD, ineffective breathing pattern, impaired posture, reduced lung expansion, activity intolerance and anxiety. [9]

Transcutaneous Electrical Nerve Stimulation (TENS) is a low frequency electrical modality used to relieve acute or chronic pain. Conventional TENS works on pre-synaptic inhibition, in which thick afferent nerves (A- α , A- β and A- γ) are stimulated, so stimulation transmission is blocked at the level of spinal cord. TENS is found effective in treating acute post-operative pain. The obvious advantages of controlling pain postoperatively include earlier mobilization, more effective deep breathing/coughing, which will lead to earlier discharge and better recovery. [10]

The present study was aimed at finding the effect of Conventional TENS near ICD site in adjunct to traditional physiotherapy treatment in pleural effusion patients on pain, dyspnea and chest expansion.

MATERIALS AND METHODS

After obtaining ethical approval from the Institutional Review Board, 40 patients with pleural effusion meeting the inclusion criteria were screened and invited to participate in the study. Patients diagnosed with pleural effusion on chest radiograph and ICD inserted in 5th intercostal space having clinical presentation of dyspnea, localized chest pain at ICD site, non-productive cough were included in this single blinded randomized control trial. To avoid bias single blinding was done wherein intervention was given by investigator 1 and randomization and pre and post assessment of patients was done by investigator 2. Sensory, cognitive or hearing deficits, recent trauma in thoracic spine and uncomprehensive patients were considered as exclusion criteria. Informed written consent was obtained from all the participants.

Mean age of the patients in control group was 36.33 ± 14.34 and in control group was 35.94 ± 15.16 . These patients were randomly allocated in two groups viz. Control group (Receiving traditional physiotherapy) or Experimental group (receiving TENS in addition to traditional physiotherapy) using Research Randomizer software. The study design and participants distribution is shown in figure 1. After allocation baseline measures of pain and dyspnea on 10 point Visual analogue scale (VAS) and chest expansion at 4th intercostal space with centimeter tape were taken. [11-13]

The Control group received supervised sessions of traditional physiotherapy treatment comprising of Pursed lip breathing (18-20 reps), Segmental breathing (18-20 breaths /session with frequency of 6 breaths/minute), positioning to facilitate fluid drainage with ICD site down, active Limb mobilization and patient education on ICD site care once in a day for 5 days. The experimental group received Conventional TENS (frequency =80 Hz, intensity= as tolerated by the patient, two electrodes placed around the ICD site) for 15 minutes in addition to

traditional physiotherapy treatment once in a day for 5 days.

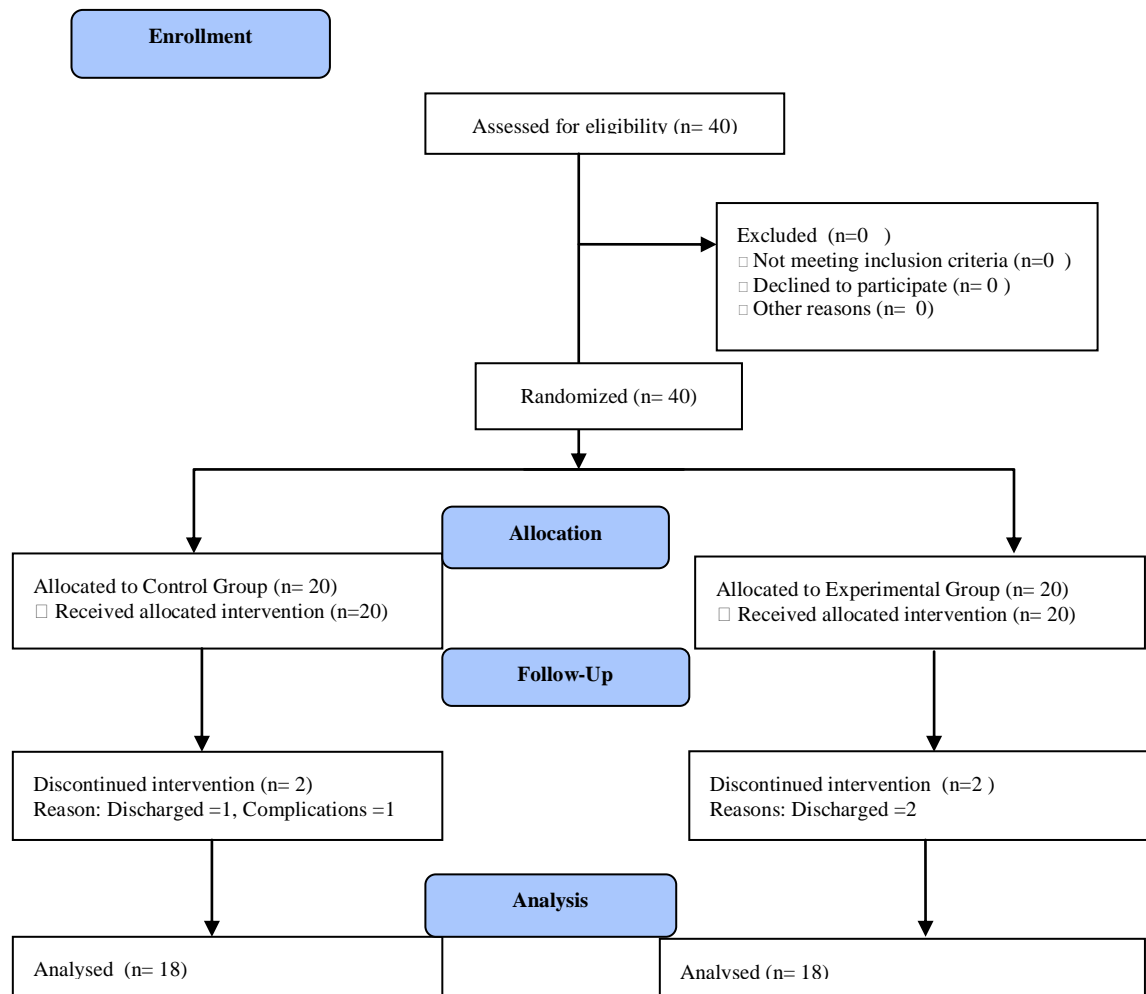


Fig 1: Study Design

DATA ANALYSIS:

Data was analyzed using SPSS (Statistical Package for The Social Sciences) software version 16.0. Wilcoxon Signed Rank Test was used within group and Mann Whitney U test was used between groups for Visual Analogue Scale for Pain and dyspnea. Paired T test was used within group and unpaired T test between groups for Chest expansion.

Level of significance was set at 0.05.

RESULTS

It was observed that there was significant improvement in pain, dyspnea and chest expansion in control as well as experimental groups. (Table no. 1 and 2)

When mean differences in post and pre values for pain, dyspnea and chest expansion were compared between control and experimental groups, pain and dyspnea scores were significantly lower and chest expansion was significantly higher in experimental group with p value <0.001* for all 3 parameters. (Table no. 3)

Table 1 : Results of Experimental Group analysis

PARAMETERS	PRE-RX (MEAN)	POST-RX (MEAN)	P-VALUE
Pain (VAS)	6.11 ± 1.54	2.15 ± 1.08	<0.001*
Dyspnea(VAS)	4.99 ± 2.21	2.05 ± 1.31	<0.001*
Chest Expansion (cm)	0.65 ± 1.99	1.19 ± 0.27	<0.001*

Table 2 : Results of Control Group analysis

PARAMETERS	PRE-RX (MEAN)	POST-RX (MEAN)	P-VALUE
Pain (VAS)	5.16 ± 1.94	4.34 ± 1.93	<0.001*
Dyspnea (VAS)	4.81 ± 1.83	4.06 ± 1.63	<0.001*
Chest Expansion (cm)	0.70 ± 0.19	0.85 ± 0.16	<0.001*

Table 3 : Results of Between Control and Experimental Group analysis

PARAMETERS	P-VALUE
Pain Difference(VAS)	<0.001*
Dyspnea Difference (VAS)	<0.001*
Chest Expansion Difference(In cm)	<0.001*

(Here p-value is < 0.001, * denotes statistically significant change)

DISCUSSION

The results obtained in this study showed that patients in both the groups i.e. the ones receiving traditional treatment only and the other receiving traditional treatment with TENS showed statistically significant improvement on pain, dyspnea and on chest expansion. A significant change was also seen between both the groups suggesting that Conventional treatment coupled with TENS had additional effect on pain, dyspnea and chest expansion.

Respiratory physiotherapy including breathing exercises, postural exercises and mobilizations, sputum clearance exercises and education combined with medical treatment and drainage in pleural effusion results in reduced length in hospital stay and better recovery. This combined therapy induces intrathoracic pressure changes leading to better drainage and hence better expansion. [14] A study by Gunjal et al. found that segmental breathing exercises proved more effective when compared to deep breathing exercises in improving chest expansion and pulmonary mechanism there by stimulating stretch reflex mechanism. The stretch to external intercostals facilitates their contraction and hence assisting inspiration. This in turns improves expansion of the lungs. [15]

A study by Humaira Ansari et al. demonstrated that conventional therapy i.e. diaphragmatic breathing, thoracic expansion exercises and pursed lip breathing along with positive expiratory therapy was effective in improving expansion, SpO2 and relieving dyspnea, the negative pressure created allows expansion of the adjacent alveoli. [16] PEP facilitates chest expansion

by improving the contractile properties of respiratory muscles which are mainly responsible for dyspnea i.e. pattern of tension development, functional weakening (hyperinflation) and fatigue. This in turn improves lung function and reduces pulmonary hyperinflation thereby relieving dyspnea. [17]

TENS is a routinely used electrotherapeutic modality in physiotherapy for pain relief. In acute post-operative period TENS is used as an adjunct with analgesics, with obvious benefits of pain relief, early mobilization and effective breathing and in turn reducing hospital stay. Conventional TENS, a high frequency TENS works on pre synaptic inhibition and thus helps in pain relief.

A systemic review by A. Freynet et al demonstrated that seven of the nine studies presented were clearly in favor of TENS as an adjuvant to narcotic analgesics for improving post thoracic surgery outcomes. The interest and benefits was seen on pain relief and also reduced use of narcotics analgesics was seen, in addition reduced duration of recovery-room stay, increased chest physical tolerance with pulmonary function improvement was seen. Thus shows TENS with postoperative medications is safe and effective in alleviating post-operative pain and improves post thoracic surgery recovery. [18]

V. Kiran et al demonstrated that application of TENS in addition to conventional physiotherapy in post-operative median sternotomy patients improved pain and FVC and also reduced atelectasis. [19] A study done by Barbara Rakel et al in post abdominal surgery patients showed that TENS significantly decreased pain intensity during activities like deep breathing maneuvers and waling and it significantly improved the distance and speed of subjects postoperatively when

used as a supplement to pharmacologic analgesia. [20]

Thus it can be attributed that pain being a major attributor to decreased lung expansion post ICD insertion, relieving pain would in turn help in improving expansion and relieving dyspnea.

The finding of present study encourages use of adjunct therapy like TENS for improving functional outcomes in patients with chest drains.

CONCLUSION

From the present study it can be concluded that Conventional TENS can be used as an adjunct to traditional physiotherapy to decrease pain, dyspnea and improve expansion of the chest .

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