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RESEARCH ARTICLE

EPIDEMIOLOGY OF CANCER AND ROLE OF PHYSIOTHERAPY IN PAIN MANAGEMENT IN PATIENTS WITH MALIGNANT PLEURAL EFFUSION WITH ICD

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ABSTRACT

Background: Malignant pleural effusion (MPE) is a clinical condition and common complication that develops in cancer patients in many types of tumors, its presence indicates the onset of the terminal stages of cancer. Transcutaneous electrical nerve stimulation (TENS) has been used extensively to control pain mainly in post-operative thoracotomy patients, but its effects are controversial. So present study aims to study the role of transcutaneous electrical nerve stimulation in pain Management using the NPRS Scale for patients with Malignant pleural effusion with an Intercostal Drainage (ICD) Tube. ***Method:*** An experimental study was done at Pravara Rural Hospital and a total of 44 patients with malignant pleural effusion with intercostal drainage tube were assessed for this study. The effectiveness of TENS was assessed by the numerical pain rating scale (NPRS).Transcutaneous electrical nerve stimulation (TENS) with High Frequency (100 to 120 HZ) and low intensity was given for 2 weeks. ***Result:*** Pre-intervention mean value of NPRS Score (Pain Intensity)in participants of the experimental group was 7.30±0.92 and after 2 weeks of intervention it was 2.82±0.83. The difference between the pre and post-values of the NPRS Score (Pain Intensity)in the experimental group was 4.47and it shows a highly significant difference in pre and post-intervention pain intensity. ***Conclusion:*** This study concludes that physiotherapy modalities like Transcutaneous Electrical Nerve Stimulation are safe and effective in pain management in Malignant pleural effusion with an ICD tube.

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INTRODUCTION

Cancer is a generic term for a heterogeneous group of diseases that occur when abnormal cells are not destroyed by normal metabolic processes, but instead proliferate and metastasize out of control. Lung cancer is the leading type of cancer diagnosed in males worldwide. In females, breast cancer, colorectal cancer and cancer of the cervix uteri are commonly seen. Multiple factors are understood to play a role in the induction of lung carcinogenesis. Tobacco smoking is the leading cause. Other risk factors include exposure to environmental or occupational carcinogens, pulmonary inflammation, airflow limitation, chronic obstructive pulmonary disease (COPD) and genetic predisposition (1, 3, 4). Weaker evidence links physical inactivity and poor nutrition to an increased risk of lung cancer. Non-small cell lung cancer (NSCLC) is the most common type of lung cancer and accounts for 85% of new lung cancer diagnoses (3). Lung cancer is a disease predominantly seen in the elderly population; more than 80% of people diagnosed with lung cancer are aged 40 years or older. Due to the high incidence of smoking among people with lung cancer, multi-morbidities are common. Due to the etiology of lung cancer, the older age of patients, and the presence of multi-morbidities, people with lung cancer constitute a complex patient population to manage (1,2).

The medical treatment of lung cancer has improved over recent decades; however, lung cancer remains the leading cause of cancer death worldwide and the overall 5-year survival rate is 14%. It includes surgical resection, chemotherapy, radiotherapy and targeted agents. The choice of treatment combination depends on the histological type, tumor location, cancer stage and the patient's degree of frailty (3,4). Pleural effusion is a commonly diagnosed condition among respiratory diseases. It is defined as an excessive accumulation of serous fluid between the parietal pleura and visceral pleura (i.e. within the pleural cavity).The symptoms of pleural effusion include dyspnea, pleuritic chest pain, cough, fever, chills, and weight loss. (5,) Malignant pleural effusion (MPE) is an exudative effusion with malignant cells. MPE is a common symptom and accompanying manifestation of metastatic disease. It affects up to 15% of all patients with cancer and is the most common in the lung, breast cancer, lymphoma, gynecological malignancies and malignant mesothelioma. A malignant pleural effusion (MPE) is often the first sign of cancer and it is a prognostic factor in patients with advanced disease. MPE can be a complication of any malignancy, but in patients with lung cancer, the frequency of MPE ranges from 7% to 23%. MPE is one of the common causes of exudative and unilateral pleural effusion and occurs in up to 15% of all cancer patients (7,8). Malignant pleural effusion (MPE) is a clinical condition and common complication that develops in cancer patients in many types of tumors, its presence indicates the onset of the terminal stages of cancer.

Physical examination findings show the fullness of the affected chest, bulging of the intercostal spaces and reduction in the chest movements on the affected side (10,11). Medical management of pleural effusion includes treatment of underlying cause with antibiotics, treatment of pleuritic chest pain with analgesics like paracetamol, aspiration of fluid may be necessary to relieve dyspnea, insertion of chest tube if rapid accumulation of fluid occurs & pleurodesis in malignant effusion.(12) Chest drains are also referred to as under-water sealed drainage, thoracic catheter, tube thoracotomy or intercostal drainage tube. The intercostal drainage tube (ICD) is inserted as an invasive procedure for removal of fluid, from the pleural space or mediastinum or re-expand the lung and restore negative intrapleural pressure and respiratory function (13,14). Pain is a common symptom felt during the postoperative period at the incision site, which might interfere with pulmonary functions and healing. Thus, the goal of the therapist is to develop an analgesic regimen that provides effective pain relief in post-thoracotomypatients (15). Transcutaneous Electrical Nerve Stimulation (TENS) is a method of producing electro-analgesic effects through the spinal cord gating mechanism. TENS has been used as an effective adjunct for providing post-operative pain control. TENS facilitates movement and exercise by decreasing pain perception and improving physical functioning. (Wall & Melzack, 1989; Bonica, 2001) (16). Hypoventilation does occur in certain areas of the lungs because of pain and muscle guarding in patients with pleural effusion with intercostal drainage. Few studies concluded that TENS is effective and safe in reducing pain in post thoracotomy So, the present study aims to study the Role of Transcutaneous Electrical Nerve Stimulation in pain Management for patients with Malignant pleural effusion with Intercostal Drainage Tube.

METHODOLOGY

Source of Data: Pravara rural hospital, In-Patient Oncology ward & Medicine Ward.

Study Design: Pretest-Posttestcontrol group design.

Sample Size: 44

Participants: Individuals with cancer with malignant pleural effusion with intercostal drainage.

Selection criteria: The inclusion criteria of the study were both male and female patients,aged between 20 to 70 years, patients with cancer, unilateral malignant pleural effusion and patients with intercostal drainage tubes. Exclusion criteria of the study were otherpleural conditions like hydrothorax, pneumothorax, empyema thoracic, patients with chest trauma &and rib fracture, implanted pacemakers and known cases of cardiac disease. Outcome Measures: The outcome measure of the study wasthe numerical rating scale (NRS). This scale is used to measure the severity or intensity of intercostal pain which was due to intercostal tube placement on the affected side. This is an11-point scale ranging from "0" representing no pain to "10" representing worst pain.

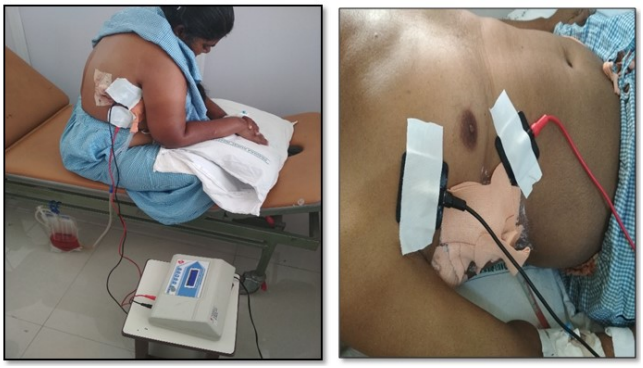
Groups: A totalof 44 patients in the study were randomized into 2 groups: Group A (Control group) consisted of 21 patients and given medical treatment including ICD. Group B (Experimental group) consists of 23 Patients treated with medical treatment including ICD and TENS for pain management.

Intervention Protocol

Transcutaneous Electrical Nerve Stimulation (TENS):

- **Type:** Conventional TENS: High Frequency (100 to 120 HZ) & Low intensity
- Electrode placement atthe side of the incision or ICD tube.
- Time 10 to 20 min &and once a day for 2 weeks.

Patient photographs with application of TENS Electrodes at the side of ICD Tube



Patient photographs with application of TENS Electrodes at the side of ICD Tube

RESULTS

The objective of the present study was to see the Epidemiology of cancer and the role of physiotherapy in pain management in patients with pleural effusion with ICD.The effect of transcutaneous electrical nerve stimulation on Intercostal Pain Severity was assessed with the numerical pain rating scale (NPRS) in malignant pleural effusion with intercostal drainage tube. All the 44 patients completed 2 weeks of intervention.Statistical measures such as mean, and standard deviation (S.D.) were calculated and the Student's Paired 't' test and Unpaired 't' test was applied to analyze the data. The results were concluded to be statistically significant with $p<0.05$.

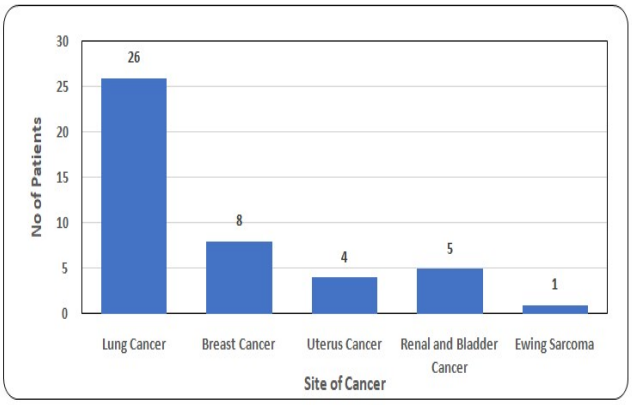
Demographics: The total number of participants selected for the study were forty-four (n=44, 25 Male and 19 Female) aged between 20-70 years after fulfilling the inclusion and exclusion criteria. Participants were randomly assigned into two groups either the Control Group (Group A) or the Experimental group (Group B).Twenty-one participants were included in the control group, of which 12 were male (57%) and 9 were female (43%). Twenty-three participants were included in the Experimental group, of which 13 were male (56%) and 10 were female (44%). There were no statistically significant differences between the control group and the experimental group in terms of anthropometrics, physical characteristics and physiological data of the participants. Epidemiological findings:Distribution of Patients based on Age Groups, Side of Effusion, primary or metastatic cancer, site of the cancer, and stages of cancer:

As per the age group-wise distribution of patients, 14 patients were in age between 21-40 years, 16 patients were in age between 41-60 years and 14 patients were in age between 61-70 years. In this study, 26 (59%) patients had pleural effusion on the right side and 18 (41%) patients had pleural effusion on the left side of the thorax. Based on site of cancer, 26 (59%) patients were diagnosed with lung cancer, 8 (18%) patients were diagnosed with breast cancer, 4 (9%) patients were diagnosed with uterus cancer, 5 (12%) patients were diagnosed with renal & bladder cancer and 1 (2%) patient was diagnosed with Ewing sarcoma. In the category of cancer, 26 (59%) patients were under the category of primary (lung) cancer, and 18 (41%) patients were under the category ofmetastatic cancer. In stages of cancer, 3 (7%) patients were associated with Stage I cancer, 14 (32%) patients were associated with Stage II cancer, 09 (20%) patients were associated with Stage III cancer and 18 (41%) patients were associated with stage IV of cancer.

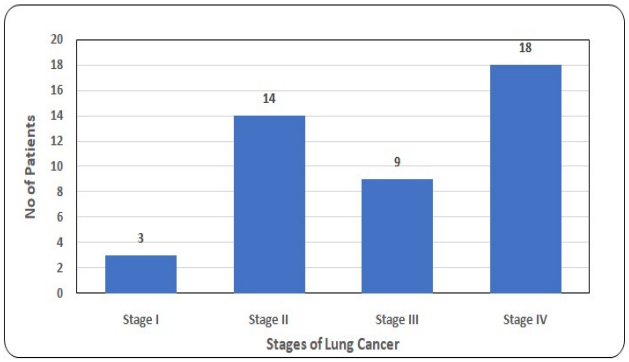
Pain Intensity on Numerical Pain Rating Scale: The pre-intervention mean value of NPRS Score (Pain Intensity)in participants of the control group was 5.90±0.88 and after 2 weeks of interventions mean value of (Pain Intensity) was 5.76±0.70. The difference between the pre and post-values of the NPRS Scorein the control group was 0.14 which shows no significant difference in pre and post-intervention Pain Intensity.

Table No.1. Epidemiological Patients Data

Patients Particulars	No of Patients
Total Cancer patients included in the study	44
Male	25 (56%)
Female	19 (44%)
Age Group	
21-40	14 (32%)
41-60	16 (36%)
61-70	14 (32%)
Primary Cancer	26 (59%)
Metastatic Cancer	18 (41%)
Side of Pleural Effusion	
Right	26 (59%)
Left	18 (41%)
Site of the Cancer	
Lung	26 (59%)
Breast	8 (18%)
Uterus	4 (9%)
Renal and Bladder	5 (12%)
Ewing Sarcoma	1 (2%)
Stages of Cancer	
I	3 (7%)
II	14 (32%)
III	09 (20%)
IV	18 (41%)

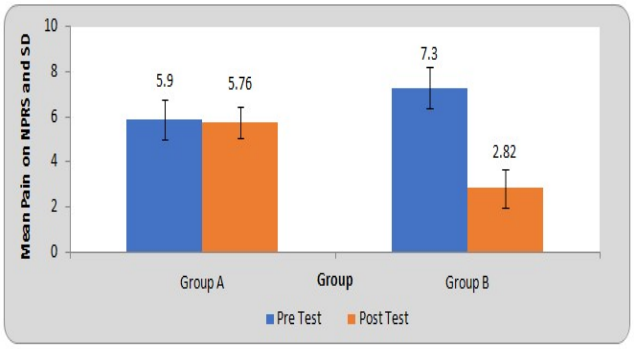


Graph No.1 Distribution of Patients bases on Site of Cancer



Graph No.2. Distribution of Patients based on Stage of cancer

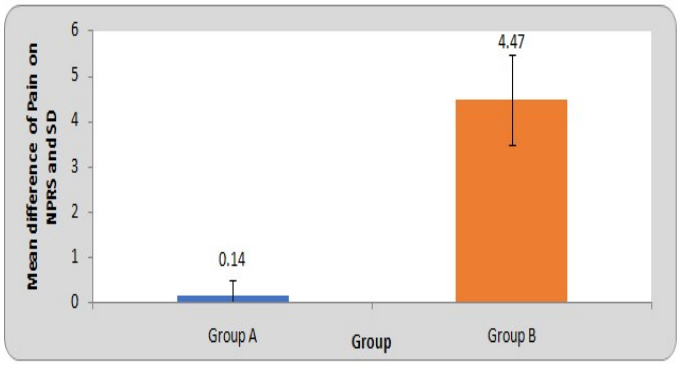
Before the intervention, the mean value of NPRS Score (Pain Intensity)in participants of the experimental group was 7.30±0.92 and after 2 weeks of intervention, the mean value of NPRS Score (Pain Intensity)was 2.82±0.83. The difference between the pre and post-values of the NPRS Score (Pain Intensity) in the experimental group was 4.47. which shows a highly significant difference in pre and post-intervention pain intensity. Student's Unpaired 't' test was used to compare between the control group and the experimental group revealing that there was a statistically significant difference (p value-0.0001) in NPRS Score (Pain Intensity) in between the two groups.



Graph 3. Pre-post comparison of Pain on NPRS of both the groups

Table no.2. Pre-post comparison of Pain on NPRS Scale of both the groups

Group	Pre Test	Post Test	Mean Difference	t-value	p-value
Group A(n=21)	5.90±0.88	5.76±0.70	0.14±0.35	1.82	0.83,p>0.05 Not Significant
Group B(n=23)	7.30±0.92	2.82±0.83	4.47±0.99	21.60	0.0001, p<0.05 Highly Significant



Graph no. 4. Mean difference comparison of Pain on NPRS Score of both the groups

Table no. 2. Mean difference comparison of Pain on NPRS Score of both the groups

Pain on NPRS	Group A (Mean Difference)	Group B (Mean Difference)	t-value	p-value
	0.14±0.35	4.47±0.99	18.80	0.0001, p<0.05 Significant

DISCUSSION

The present study was conducted to see the epidemiology of cancer and the role of physiotherapy in Pain management in Malignant pleural effusion with ICD. This study showed that Physiotherapy Modality like Transcutaneous Electrical Nerve Stimulation (TENS) was effective in reducing pain in a patient with an Intercostal drainage Tube. The present study also adds important information to the existing literature that most malignant pleural effusions are due to metastatic lung cancer in men and metastatic breast cancer in women. Lung and breast cancer account for 50-65% of all malignant pleural effusions (9) Thoracotomy or insertion of an intercostal drainage tube is one of the most painful incisions the patient can experience. Pain inhibits the effectiveness of coughing, affects deep breathing, and restricts the upper limb mobility of the affected side, this results ina reduction of lung volume and lung capacities and also result in a reduction of pulmonary functions, and causes restrictive ventilatory defect (14).

The application of TENS helps in pain reduction and indirectly improves the lung volume and capacities this helps the patient to breathe effectively and indirectly improves pulmonary functions. The mechanism behind this was the 'gate control' theory of pain as postulated by Melzack and Wall. The pain was largely transmitted by small unmyelinated C fibers which could be inhibited by the activation of myelinated Aδ& Aβ fibers. By the stimulation of these large diameter Aδ& Aβ fibers it could close the signals from a spinal segment by gating mechanism in the substantia gelatinosa and thus can prevent painful peripheral stimuli from gaining access to higher cortical centers (13). Another mechanism to relieve pain by using TENS is the release of inhibitory neurotransmitters endorphin, dynorphin and enkephaline in substania gelatinosa. It inhibits the C fibers and ultimately pain is reduced by these two mechanisms. (13)
A similar study conducted by Cristie Gregorini et al conducted on short-duration transcutaneous electrical nerve stimulation in the postoperative period of cardiac surgery. In this study,twenty-five patients were randomly assigned to two groups. One group received therapeutic TENS (n = 13) and the other, placebo TENS (n = 12), for four hours on the third postoperative day of cardiac surgery. Pain was analyzed by means of a visual analogue scale, and of respiratory muscle strength as measured by maximum respiratory pressures and lung capacity and volumes before and after application of TENS. This study concluded that Short-duration TENS proved effective for the reduction of pain and improvement of respiratory muscle strength, as well as of lung volumes (18).

Another study was conducted by Celal Bugra Sezen et al on transcutaneous electrical nerve stimulation effect on postoperative complications. 87 patients underwent a standard posterolateral thoracotomy and were randomized in 2 groups: group T was 43 patients who had transcutaneous electrical nerve stimulation and group C was 44 patients who had placebo Stimulation with an inoperative device. Pain score was measured using a visual analogue scale ranging from 0 to 10. The frequency of the device was set at 100 Hz and pulse width at 100 ms. This study concluded that electrical stimulation is a safe and effective adjunctive therapy for acute post-thoracotomy pain (19). A Randomized clinical trial conducted by Alireza Jahangirifard et al on the effect of TENS on Postoperative Pain and Pulmonary Function in Patients Undergoing Coronary Artery Bypass Surgery.

In this study, 100 patients undergoing CABG were divided into two groups. In the intervention group 50), patients received routine care along with TENS. In the placebo group (50) patients only received routine care. The pain intensity &and pulmonary functionswere assessed at 24, 48, and 72 hours after surgery. Pain intensity was significantly lower in the TENS group than the placebo group in both resting and coughing conditions ($p < .05$). TENS may reduce postoperative pain in resting and coughing conditions, improve pulmonary function, and reduce narcotic use in patients (20). A Systematic review alsosupports the present study which is conducted by Sukhyanti Kerai et al on the role of transcutaneous electrical nerve stimulation in postoperative analgesia. Most of the studies have demonstrated clinically significant reduction in pain intensity in postoperative patients.(21)

CONCLUSION

This study concludes that Physiotherapy modalities like Transcutaneous Electrical Nerve Stimulation are safe and effective in pain management in cancer patients with an intercostal drainage tube and they can be added as a routine treatment protocol for pain Management.

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Conflicts of interest: None Declared

Ethical Approval: The study was approved by the University Ethics Committee

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