



EFFECT OF NINE WEEKS OF AEROBIC EXERCISES AND DIAPHRAGMATIC STRENGTHENING VIA TELE-REHABILITATION ON PULMONARY FUNCTION IN CANCER PATIENTS- AN EXPERIMENTAL STUDY

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ABSTRACT

Background and Aim:- Neoadjuvant chemotherapy is one of the common choices of treatment for cancer patients. The important complication of neoadjuvant chemotherapy is altered pulmonary functions. Hence the study aims to see the effect of Aerobic exercises and Diaphragmatic strengthening via telerehabilitation on pulmonary functions in Cancer patients who are undergoing neoadjuvant chemotherapy. **Methods and materials:-** Nine patients diagnosed with cancer and undergoing neoadjuvant chemotherapy were assigned for nine weeks of aerobic exercise and diaphragmatic strengthening protocol for 30 minutes each session and 5 times weekly. Pulmonary function was assessed pre and post nine weeks of intervention. **Results:-** Pulmonary functions were affected in patients diagnosed with cancer and undergoing neoadjuvant chemotherapy. Clinically there was an improvement in pulmonary functions between pre and post-intervention, though statistically there was no significant difference. **Conclusion:-** Aerobic exercises and diaphragmatic strengthening exercises can improve pulmonary functions clinically and reduce the side effects associated with neoadjuvant chemotherapy on pulmonary functions

KEYWORDS : Tele-rehabilitation, Neoadjuvant chemotherapy, Aerobic exercises, pulmonary functions.

INTRODUCTION

In cancer disease, the division of cells is uncontrolled and it spreads to adjacent tissues. The internal and external lining of body is the places form where carcinomas originates and are referred to as neoplasms¹. There is estimation that 19.3 million new cancer cases were diagnosed in 2020 in the world². Risk factors for developing cancer are genetics, age, environmental factors, occupational hazards, diet, and lifestyle^{3,4}. Classification of Cancer is been done by using TNM classification system.

Recently neoadjuvant chemotherapy is the common choice of treatment in the patients diagnosed with cancer. The importance of neoadjuvant chemotherapy is to reduce postoperative complications by decreasing tumor volume and improving surgery results. Drug like Carboplatin was introduced with cisplatin for treatment as it has less toxicity and no difference in survival in carcinomas. Combination of paclitaxel and cisplatin chemotherapy is preferred for the treatment⁵.

There is evidence that major adverse effect of neoadjuvant chemotherapy is reduced pulmonary function and lung capacity^{6,7}. Currently, Physiotherapy plays a major role in preventing these complications⁸. At the same time Cancer patients are more vulnerable and at high risk of infection and disability hence Physiotherapy must be feasible, cost effective, and easily available to such patients. A great advantage of technology can be taken in such conditions and during the time of pandemic (Covid 19) by starting telerehabilitation⁹.

The study aims to see the effect of Aerobic exercises and Diaphragmatic strengthening via telerehabilitation on pulmonary functions in Cancer patients who are undergoing neoadjuvant chemotherapy.

MATERIAL AND METHOD

Participation

At first ethical clearance was obtained from the Institutional Ethical Committee. The research involved nine patients who were diagnosed with breast, lower abdominal, cervix, ovary, and prostate cancer and undergoing platinum-based neoadjuvant chemotherapy for nine cycles. And who were qualified for physiotherapy via telerehabilitation at Tertiary Care Medical College and Hospital, Department of Radiation Therapy and Oncology in 2021-2022. Eligible patients were given their preliminary consent for participating in the study; patients were offered detailed information and had the opportunity to ask questions.

The inclusion criteria were patients diagnosed with carcinomas and undergoing neoadjuvant chemotherapy, age 30-59years, approval of primary attending oncologist, absence of significant cardiac disease, > 60 Karnofsky performance status, having a smartphone, and was able to make a video call.

Neoadjuvant Chemotherapy

All the patients underwent nine weeks of neoadjuvant chemotherapy treatment with Platinum-based chemotherapy drugs i.e. Cisplatin and Carboplatin.

Outcome measure

According to ATS guidelines Pulmonary Function tests: - FVC, FEV1, FVC/FEV1, PEFR

At first patients, age, weight, height, and BMI were recorded. The test was demonstrated by the therapist to the patient. The patient was asked to sit upright and with arms well supported on a chair. Patient was instructed to inhale completely by the nose and then nose clip was applied. Then the patient was given the mouthpiece and asked to close the lips around the mouthpiece and performed forceful exhalation¹⁰. All patients

were asked to perform the test three times and best of three was considered for final data.

Intervention

A total of nine patients underwent aerobic exercises and diaphragmatic strengthening exercises for nine weeks via telerehabilitation using WhatsApp video calling. All sessions were held in the morning time. Each session consists of 30 minutes of moderate-intensity exercises according to ACSM guidelines with Diaphragmatic strengthening exercises by using 1kg weight on the diaphragm and patients were asked to do 30 maximal voluntary diaphragmatic contractions and incentive spirometer ¹¹. Each session started with warm and ended with cool-down exercises. For safety purposes, all patients were given pulse oximeter so that pulse and saturation can be monitored continuously during the telerehabilitation session.

A. Aerobic exercises: -

Frequency:- 5 days/week

Intensity:- 64% to 75% HR max. Karvonen formula for calculating HRmax i.e. (220- HRrest)

Time:- 30 minutes/day with accumulated shorter bouts if necessary.

Type:- prolonged, rhythmic activities using large muscle groups (e.g. spot marching, sit to stand, air cycling) ¹²

5 minutes of warm-up exercises (ROM exercises for upper and lower limbs with trunk exercises)

↓
Break for 30 seconds

↓
10 repetitions of incentive spirometer and Diaphragmatic strengthening exercises (30 maximal voluntary contractions)

↓
30 seconds break

↓
1 minute of air cycling in supine

↓
Break for 30 seconds

↓
1 minute of air cycling in supine

↓
30 seconds of break

↓
1 minute of sit to stand (at patient's comfortable speed)

↓
30 seconds break

↓
1 minute of sit to stand (at patient's comfortable speed)

↓
30 seconds break

↓
1 minute of spot marching (at patient's comfortable speed)

↓
30 seconds break

↓
1 minute of spot marching (at patient's comfortable speed)

↓
30 seconds break

↓
Walking for 10 minutes (which will be monitored by the app used in android phones named "Fit")

↓
Break for 30 seconds

↓
Cooldown exercises for 5 minutes (stretching exercises, deep breathing exercises, and Shavasan)

Statistical Analysis

Data analysis was done using GraphPad InStat Demo. The difference between the pre and post FVC, FEV1 and FEV1/FVC

was done using Student t-test and PEFR values were calculated using Wilcoxon signed-ranks tests. Two tailed test were used at significant p-value of 0.05.

RESULTS: -

Demographic characteristic

Of the initially screened 12 patients only nine were eligible according to inclusion criteria. As shown in Table 1 shows the descriptive data of the characteristics of the patients included. Mean age of the participants was 45 years old, whereas mean Karnofsky performance status is 85 score.

Table 1: - Patient characteristic and demographic data

Characteristics/Demographic	Mean ± SD	P value
Gender	1.667±0.50	0.0001
Age	45±8.703	0.0001
Karnofsky Performance Status	85.56±5.270	0.0001
BMI	24.80±5.610	0.0001
Height	157.00±7.036	0.0001

Table 2: - Difference between pre and post treatment in pulmonary function

	Pre %Mean ±SD	Post % Mean±SD	Mean difference ±SD	P value	t-value	Result
FVC	109.89±20.015	126.11±20.362	-16.222±25.709	0.950	1.893	Not quite significant
FEV1	120.78±24.340	140.00±25.807	-19.222±26.962	0.064	2.139	Not quite significant
FEV1 /FVC	110.67±9.526	113.44±10.382	-2.778±9.107	0.386	0.915	Not significant
PEFR	459.14±1360.4	6.807±0.07	452.33±1360.4	0.425	-8	Not significant

It has been seen that in all the parameters of pulmonary functions the difference between pre and post-FVC, FEV1, FEV1/FVC, PEFR is clinically significant but not statistically.

DISCUSSION

Cancer is a disease where there is a significant decrease in pulmonary functions due to the disease itself and also because of the toxic effect of cancer-related treatment like neoadjuvant chemotherapy¹³. Aerobic exercises and diaphragmatic strengthening are very much important to prevent this complication or at least to prevent the severity of this complication. Cancer patients are more vulnerable to infections, but at the same time, physical activity was very important. Patients couldn't visit hospitals and clinics only for exercise during the tough times of SARS.Co.V-2 pandemic. Nowadays we have advanced technology which can be used in such times hence telerehabilitation is one of the best methods to give treatment to patients on almost all days of the week¹⁴.

Based on current results it has been observed that a possible impact of telerehabilitation-based physiotherapy on pulmonary functions in cancer patients undergoing neoadjuvant chemotherapy can be established. Though statistically the results are not quite significant but clinically they are significant. Aerobic exercises improve lung recoil and elasticity. Aerobic exercise helps in the restoration of normal lung mechanism and flow accelerations rate through decrease lung hyperinflation and restoring lung elasticity. As oxygen consumption increases during aerobic exercises, the inactive alveoli also get activated because of which proper expansion of alveoli takes place.

As the respiratory rate increases initially during exercises there is repeated stimulation of inspiration and expiration which again improves alveolar compliance since more alveoli are activated more air could enter the alveoli and increase alveolar compliance which helps in increase of lung elasticity

and more expiration of air¹⁵. This explains the improvement in pulmonary functions.

Another study by Ayman AMohamed also explained in his study that aerobic exercises can improve pulmonary functions by improving lung recoil and elasticity¹⁶. Regular aerobic exercises improve the efficiency of lungs and also improve the ability to consume oxygen as during physical activity body consumed more oxygen. A study by Gamze İŞLEYEN in 2020 did a study to see the effect of aerobic exercises on pulmonary functions has explained that aerobic exercises improve the efficiency of lungs as there is more lung expansion and flexibility of bronchi and bronchioles is improved¹⁷. Another study by Chaitra B in 2012 has also proved that aerobic exercises improve pulmonary functions¹⁸.

In one study by Kulik-Parobczyk et al, 97 patients were studied for the effect of neoadjuvant chemotherapy on pulmonary function indicators, where it has been proved that there is a decline in FEV1 values after neoadjuvant chemotherapy. There are various possible reasons for such decline in pulmonary functions like chemotherapy has an impact on muscular strength. A decrease in muscular strength can affect the proper ability to take deep breaths which has direct effect on pulmonary function¹⁹. Diaphragmatic strengthening recruits the main muscle of inspiration i.e. diaphragm. As the work of the diaphragm improves other accessory muscles work less because of which pulmonary functions improves. In a study by Liu K and colleagues in 2020, they have explained that diaphragmatic strengthening helps to improve pulmonary functions¹¹. Hence in our study, we have seen that diaphragmatic strengthening and aerobic exercises via telerehabilitation have clinically positive effects on pulmonary function even if not statistically.

Similar results were seen in a study by Pfirrmann D et al in 2017, where there was an improvement in pulmonary function indicators after Physiotherapy rehabilitation. Time of rehabilitation plays an important role in seeing changes in pulmonary function indicators, especially in breast cancer patients²⁰.

The concept of telerehabilitation might have several advantages like patients can practice exercises at home comfortably; there is only one supervisor so the therapist knows the exact condition and status of patient also the time can be saved for all the patients and their relatives and also of the therapist²¹. There are many more studies that support our findings by Y.J. Cheng et al²², Reza Farid et al²³.

CONCLUSION:-

The study concluded that aerobic exercises and diaphragmatic strengthening exercises can improve pulmonary functions clinically and reduce the side effects associated with neoadjuvant chemotherapy on pulmonary functions.

Limitations and Future scope:-

As the site and size of tumor are different the results may differ from individual to individual, but a larger sample size may be used in future to get more appropriate results.

Long-term effects can be tested post neoadjuvant chemotherapy and post-surgery after 1-2 years.

Conflict of interest:- None

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