EVALUATION OF MUSCLE WEAKNESS IN COPD PATIENTS

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Introduction: Chronic obstructive pulmonary disease is a chronic inflammatory disease of airways and lung parenchyma associated with airway narrowing, alveolar wall destruction and systemic hypoxemia. The cellular mediators of inflammation spill over into the circulation and contribute to skeletal muscle dysfunction in COPD patients.

Aim: To evaluate muscle weakness in copd patients.
Objectives: To check -Peripheral muscle weakness of upper limb through hand grip and Peripheral muscle weakness in Lower limb through quadriceps muscle strength.
Methodology: 30 COPD patients satisfying the inclusion criteria were assessed which included 15 males and 15 females .They were assessed for hand grip and quadriceps strength. The handgrip strength was assessed by handheld dynamometer and quadriceps strength by sphygmomanometer test. Result: There was peripheral muscle weakness in upper limb with a mean of 15.83 (sd ±8.40), quadriceps muscle weakness with a mean of 135.17 (sd ±16.05). The Spirometry% positively correlated with handgrip and quadriceps strength with statistical p value 0.0032 and <0.0001 and r value 0.5203 and 0.8012 respectively. The Duration of copd and handgrip and quadriceps strength positively correlated with p value 0.0207 and <0.0001 and 0.5204 and 0.7582 respectively. Conclusion: There was significant skeletal muscle weakness in copd patients. There was positive

correlation between spirometry% and handgrip and quadriceps strength also there was positive correlation between duration of COPD and handgrip and quadriceps strength.

Key Words: Peripheral Muscle weakness, COPD, Sphygmomanometer, Handheld dynamometer, Hand Grip.

INTRODUCTION

Chronic Obstructive Pulmonary Disease is a chronic inflammatory disease of the airways and lung parenchyma associated with airway narrowing, alveolar wall destruction and systemic hypoxaemia.(1) The Global Initiative for Chronic Obstructive Lung Disease (GOLD) defines chronic obstructive pulmonary disease (COPD) as "a preventable and treatable disease, characterized by a persistent airflow limitation that is progressive and not fully reversible and associated with an abnormal inflammatory response of the lungs to noxious gases or particles. Exacerbations and co morbidities contribute to the overall severity in individual patients".(6) It includes Chronic Bronchitis , Chronic Bronchiolitis and emphysema.It is not fully reversible.(7)

COPD has both pulmonary and systemic components. An enlargement of mucus-secreting glands and an increased number of goblet cells in the larger airways contribute to enhanced secretion of airway mucus that manifests as chronic bronchitis . Loss of elastic tissue surrounding the smaller airways , accompanied by inflammation and fibrosis in the airway wall and mucus accumulation within the airway lumen , results in airflow limitation , further increased by enhanced cholinergic tone.(7)

Patients with COPD experience increased work of breathing due to altered pressure airflow relationship. It also results in dyspnoea in patients with COPD.(7)
Ventilation-Perfusion mismatch produces abnormalities of arterial blood gases.(7)

Clinical features are presented as Persistent cough , Sputum production , Breathlessness , Dyspnoea , Muscular weakness reflecting deconditioning and cellular changes in skeletal muscles , Increased circulating inflammatory markers , Impaired salt and water excretion leading to peripheral oedema , Altered fat metabolism contributing to weight loss , Increased prevalence of osteoporosis.(7)

Risk Factors are Cigarette smoke , Physical inactivity , Age , Nutritional deficits , Hypogonadism , Vitamin D deficiency , Inflammation , Oxidative stress , Corticosteroid use , Skeletal muscle weakness is prominently seen in patients with COPD as a result of protein loss and muscle atrophy.(6)

METHODOLOGY

- Type of study : Survey based
- Sample size: 30
- Study Setup : Pulmonary

Rehabilitation Hospitals in Pune

" Target Population : COPD Patients

" Inclusion Criteria:

¢ Males & Females with COPD

¢ Spirometry - <70%

" Exclusion criteria :

¢ If Patient has undergone any recent Upper limb or Lower limb trauma or surgery.

PROCEDURE

The Ethical committee clearance was taken .The Pulmonary Rehabilitation Hospitals were approached and 35 individuals undergone baseline evaluation .Out of these, 30 individuals satisfying inclusion and exclusion criteria were evaluated for handgrip and quadriceps strength. There were 15 males and 15 females. Handgrip strength was assessed by handheld dynamometer and quadriceps strength was assessed by sphygmomanometer .The data was collected, evaluated, correlated and Statistical Analysis was done.

Handgrip assessment was done with the patient in sitting position .The shoulder was by the side of the trunk , elbow flexed to 90 degrees .Patient was asked to hold the hand-held dynamometer and press it with maximum strength.3 readings were taken. Out of these readings, maximum was recorded.

Quadriceps Strength Assessment was done with patient in high sitting position. The sphygmomanometer was inflated to 100mmHg. The cuff was placed in front of lower end of tibia and patient was asked to isometrically contract .3 readings were taken. Out of these readings, maximum was recorded.

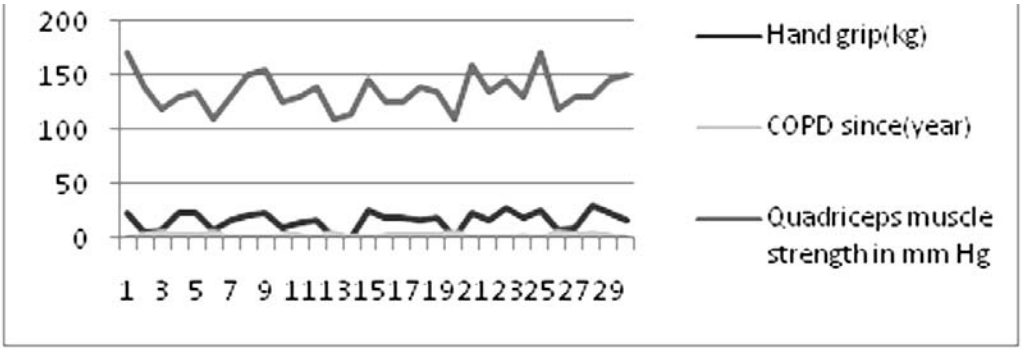
RESULTS

From Table 1 it shows that as the condition worsens or the grade of COPD advances, the condition of the patient deteriorates .Statistically it is significant by p value. From Graph 2 it 1 explains positive correlation between spirometry% with handgrip and quadriceps strength with p value 0.0032 and <0.0001 and r value 0.8203 and 0.9012 respectively. Graph 2 it states that Duration of COPD and handgrip and quadriceps strength positively correlates with p value 0.0207 and <0.0001 and r value 0.8204 and 0.7582 respectively.

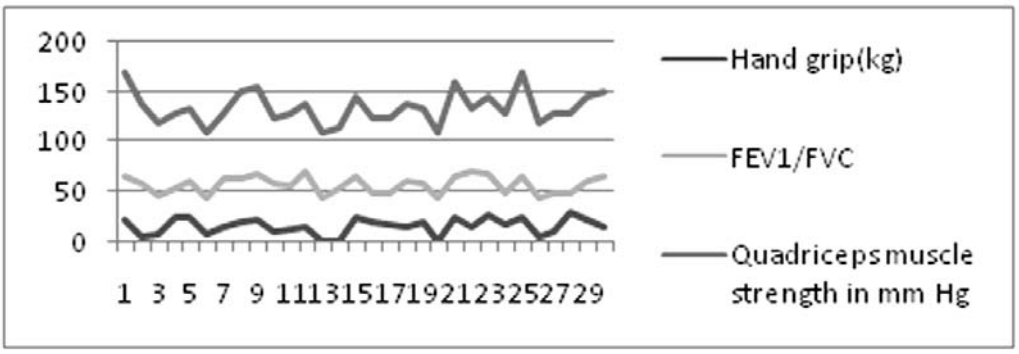
TABLE 1: Correlation of Grades of COPD :

Obstruction	FEVI/FVC % Mean ± S.D.	Handgrip Mean± S.D.	Quadriceps Mean± S.D.
GRADE 3	61.4%±5.33%	17.95±7.149	142.25±14.186
GRADE 4	45.27%±2.27%	11.6±9.477	121±8.433
P value	<0.0001	0.0491	0.002

GRAPH1:
Correlation of Spirometry% with Handgrip Strength and Quadriceps strength.



GRAPH 2:
Correlation of duration of COPD with handgrip and quadriceps strength



DISCUSSION

This study was done in order to find out skeletal muscle weakness in COPD patients. Upper limb muscle strength was evaluated by handgrip strength and that of lower limb was evaluated by Quadriceps muscle strength. Handgrip was assessed by Handheld dynamometer and Quadriceps strength was assessed by Sphygmomanometer test. Also Spirometry % was evaluated .

There were few studies which showed significant lower handgrip muscle strength & endurance. There was positive correlation between reduced handgrip muscle strength and both FEV1 and FVC %. The study showed that there was significant positive correlation between muscle strength and FVC in males ($p<0.5$) and between muscle strength and FEV1 in females ($p<0.05$).(1)

Also few studies were conducted which concluded that distribution of peripheral muscle weakness & correlation between quadriceps strength & degree of airflow obstruction suggests chronic inactivity & muscle deconditioning which is an important factors in loss of muscle mass & strength.(2)

There is skeletal muscle dysfunction in COPD patients as a results of low grade systemic inflammatory

process, nutritional depletion, corticosteroid medications, chronic inactivity, age smoking and protein degeneration. In skeletal muscle dysfunction the systemic inflammatory markers co-relate with poor muscle contractile performance.(4)

It is believed that the cellular mediators of inflammation present in the airways and alveolar walls spill over into the circulation and contribute to skeletal muscle dysfunction, cardiac failure, atherosclerosis and osteoporosis leading to poor quality of life and increased morbidity and mortality in COPD patients.(5)

There are many possible mechanisms of skeletal muscle weakness which include Disuse , Medication , Hypoxia , Hypercania , Nutrition.

Disuse is one of the mechanism . Patients with COPD tend to reduce their level of physical activity because exertion causes unpleasant sensations. A vicious cycle can result, with reductions in physical activity producing more deconditioning, and more impairment in skeletal muscle function leading to more symptoms at lower levels of work. Inactivity produces a number of structural and biochemical changes .(5)

Medications also lead to muscle weakness. Short courses of high-dose corticosteroids are used to treat acute exacerbations in patients with COPD. Low dose oral corticosteroids have been used chronically to treat some patients with COPD. Medications leads skeletal muscle dysfunction.(5)

Chronic hypoxia adversely affects skeletal muscles. With prolonged exposure to high-altitude hypoxia, glycolytic enzyme activity increases, whereas oxidative enzyme activity decreases . Hypoxia also increases oxidative stress, which can adversely affect muscle performance.(5)

Short-term exposure to hypercapnia results in skeletal muscle weakness, but no change in fatigability. In acute hypercapnic respiratory failure marked derangements in energy metabolism are seen, with marked reductions in ATP and phosphocreatine concentrations. Acute hypercapnia also contributes to intracellular acidosis in patients with acute respiratory failure.(5)

Nutritional depletion is common in patients with COPD. A prolonged period of under-nutrition results in a reduction in muscle strength and endurance. Under nutrition results in a reduction in muscle mass and fibre atrophy.(5)

Deconditioning is a major contributor to the skeletal muscle dysfunction seen in patients with COPD. These patients generally assume a sedentary lifestyle to avoid the dyspnoea that physical activity brings. The changes include reduction in oxidative enzyme capacity and proportion of type I fibres; and atrophy of type I fibres.The degree of deconditioning is highly dependent on the causes and duration of inactivity.(1)

Patients with COPD often complain of dyspnoea on exertion,

reduced exercise capacity and develop a progressive decline in lung function .These symptoms have been attributed to increase in the work of breathing and in impairments in gas exchange that result from airflow limitation and hyperinflation.(1)

Management of COPD should not be limited to symptomatic relief of respiratory symptoms. Pulmonary rehabilitation done in COPD patients should include effective exercise training for increasing the muscle strength and endurance.(1) An endurance training program produces a number of morphologic and physiologic changes within the exercising muscle that increase its aerobic capacity.(5)

CONCLUSION

There is significant skeletal muscle weakness in COPD patients. There is positive correlation between spirometry% and handgrip and quadriceps muscle strength. There is positive correlation between duration of COPD and handgrip and quadriceps muscle strength.

LIMITATIONS

This study is limited because of its small sample size.

FUTURE SCOPE

The future studies may include the effects of corticosteroids in COPD patients. It may also include evaluation of muscle weakness in COPD with other grades and to assess muscle strength with different techniques.

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