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Handgrip Strength: A Determinant of Improved Exercise Endurance Time After Pulmonary Rehabilitation in COPD

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Objectives: Exercise endurance time is one of the important outcome measures that can be used to assess the interventional efficacy of the pulmonary rehabilitation programs. Weakness, measured by a hand dynamometer was shown as a prognostic marker for all-cause mortality in the general population. In addition, previous studies have shown that a low HGS below normative range is associated with increased mortality in COPD. Several associations of HGS, such as severity of airflow obstruction, BMI, 6-minute walking distance, functional exercise capacity measures and risk of future COPD exacerbations were defined in COPD patients. We aimed to assess whether HGS is associated with improvement in functional exercise capacity measures following a standard pulmonary rehabilitation program in COPD.

Methods: COPD patients referred to an out-patient PR program were consecutively enrolled. All of the patients underwent six-minute walking test (6MWT), incremental shuttle walking test (ISWT), endurance shuttle walking test (ESWT) and HGS measurement with a hand dynamometers before and after completing a standard pulmonary rehabilitation program including both resistance and endurance training. Regression models were used to determine possible associations between HGS and functional exercise measures.

Results: A total of 22 COPD patients (M/F:18/4) with a 41.7±2.7 years old were consecutively enrolled. Mean FEV_1 and FEV_1/FVC were 1.17±0.12 L and %41.7±2.7. Significant improvements were observed in the distance walked in ISWT (291.2±42.4 vs. 378.7±44.5v meters, p=0.001), endurance time walked in ESWT (281.7±29.5 vs. 440.8±69.5 seconds, p=0.016) and HGS (20.9±1.9 vs. 27.3±4.6 Kgf, p=0.020) at the end of the PR program compared with the baseline measurements. Baseline HGS was a significant predictor of delta endurance time at the end of the pulmonary rehabilitation program after adjusting for age, sex, body mass index, airflow obstruction severity and smoking exposure (=-26.9(-33.9 - (-19.9)), p<0.0001).

Conclusion: Improvement in exercise endurance time after pulmonary rehabilitation is associated with baseline handgrip strength in COPD patients. Hand dynamometers have several advantages, such as being easy to use, easy to store and inexpensive compared to quadriceps maximum voluntary contraction force. It is likely that HGS measured easily by a hand dynamometer is one of the determinants of the improvement after pulmonary rehabilitation in COPD.

Keywords: Handgrip strength, endurance time, copd, pulmonary rehabilitation