Retrospective Study of HIIT on 5 Patients with Cystic Fibrosis
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Abstract

Introduction and Rationale: Cystic fibrosis (CF) is a congenital disease causing mucus retention in the airways resulting in a cycle of chronic infections and inflammation, leading to obstructive pulmonary disease and eventually death. Current evidence suggests that exercise aids in breaking this cycle by increasing mucus output and clearing secretions due to the increase in ventilation and rehydration of the mucus. High intensity interval training (HIIT) is a unique form of exercise that involves bursts of intense exercise followed by periods of rest. The purpose of this study is to explore the effects of HIIT as an exercise alternative in patients with CF.

Methods: Retrospective study of 5 patients with CF who have participated in HIIT at Massachusetts General Hospital (MGH) over a period of 6 months. Outcome data includes: 6MWT, FEV1, FVC, FEV1/FVC, FEF25-75, measures of peripheral muscle strength and flexibility, hospitalizations and IV antibiotic use (in days) both before and during a 6 month time period. One experienced clinician performed the initial evaluation and subsequent evaluations at month 3 and 6. Data analysis will be done via longitudinal modeling and segmental regression.

Strengths and Limitations: Strengths of this study include measuring multiple outcomes, exercise program flexibility, fixed exercise intensity, and offering a unique approach to treatment for this patient population. Limitations include a small number of subjects, variability in patients’ medications, disease progression, and age.

Relevance: This study focuses on HIIT, a novel approach to treat patients with CF. Only two studies have researched the efficacy of HIIT and patients with CF therefore additional exploration is required.

Background

What is Cystic Fibrosis (CF)?

• CF is a congenital multisystem disorder which is most prominent in the lungs. Ion transport of sodium and chloride is disrupted in the respiratory epithelium membrane. This leads to thickened mucus the patient has difficulty expectorating. The retention of mucus leads to bacterial growth and infection including pneumonia and bronchitis. These infections can cause an inflammatory cascade which leads to subsequent infection and further mucus retention. This is a vicious cycle that can lead to respiratory failure, often a complication that can lead to CF-related deaths.

Exercise and CF

• In patients with CF there is an increased sodium absorption from the airway surface liquid. This is responsible for increased viscosity of the mucus. The authors of this article reported that exercise partially blocks the sodium channels in the respiratory epithelium in patients with CF and helps lower ion transport of sodium and chloride viscous viscosity.

• Exercise may increase ion transport due to both increased flow and ventilation thereby helping to clear the airways of mucus and slow down the inflammatory process. I.

HIIT

• HIIT is a form of exercise that involves bursts of intense exercises with short-term recovery periods or lower intensity activity. The bursts are near maximal intensity and considered anaerobic. HIIT includes a warm-up, a main section containing maximal anaerobic bursts with recovery breaks, and lastly a cool down.

• HIIT + Chronic Dx

• In patients with COPD, HIIT training has been shown to increase VO2max, endurance capacity, time before fatigue, and aerobic and anaerobic enzyme activity and patients in an increase in type 1 fibers and decrease in type 2b fibers resulting in an overall increase in oxidative capacity. In addition HIIT provided greater functional benefits to enhance the patient’s participation in activities of daily living.

Opportunity

Method:

Design: Proposed retrospective study design to examine the effect of HIIT in patients with CF

Participants: 5 patients with CF at Massachusetts General Hospital (MGH) in Boston MA

• Inclusion Criteria: medical diagnosis of CF, free of any systemic musculoskeletal (MS) disorder, be able to travel to MGH for appointments, and be over the age of 18 years old.

• Exclusion Criteria: systemic MS disorder, unable to travel to MGH for appointments, less than 18 years old, requirement of greater than 6 L of O2 with exercise, and initiation of CF specific genetic modulator drug

Protocol:

• Retrospective chart review for all patients that includes baseline data taken at initial evaluation, and at 3 and 6 months mark. Seen for 1-2 time per week for 2-3 weeks. Patients followed up once per month to progress the program.

Outcome Measures

• Aerobic Capacity: Minute Walk Test (6MWT), Test re-test reliability: .87-.99

• Pulmonary Function Tests: FEV1 (Forced Expiratory Volume), FEV1, FVC, FEV1/FVC, FEF25-75; Reliability: .99 .12

• Strength Fit Test: Maximum push ups (§), Amount of sit ups in 1 minute (§), Duration of Static Chair Pose (sec or min), 1 repetition maximum (RM) of biceps (lbs), 1 RM of triceps (lbs)

• Flexibility Fit Test: Side bending, Superman Pose, Sit and reach, Child’s Pose

• Hospitalizations and IV Antibiotics within the last 6 months

Impact

Clinical Relevance

• Exercise has been shown to be a vital component of treatment for patients with CF. This study is exploring a unique and novel form of exercise (HIIT) on multiple outcome measures for patients with CF to assess this alternative form of exercise. HIIT has been shown to be effective in other chronic conditions such as DM, COPD, and CHF, however there are only two studies exploring HIIT in patients with CF. One of these studies was a case study, and the other was utilizing a cycle ergometer. Our study is unique due to the addition of strength training and high intensity aerobic exercise.

References


