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Case Report | Open Access

Cardiac Rehabilitation in Myasthenia Gravis

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Abstract

Introduction: Myasthenia Gravis (MG) is characterized by muscle weakness that may be exacerbated with exercise. Research on safety of exercise in MG is scarce. Patients are frequently discouraged from participation. At the same time, exercise-based cardiac rehabilitation is a class I recommendation for patients recovering from Myocardial Infarction (MI) and Percutaneous Coronary Intervention (PCI). Rehabilitation of cardiac patients suffering from MG presents a unique challenge for clinicians.

Methods: We describe a cardiac rehabilitation (CR) program in a patient status post STEMI (ST-Elevation Myocardial Infarction) and PCI with a fifteen-year history of MG.

Results: The patient was able to successfully complete a 36-session program consisting of aerobic, strength and flexibility training, showing marked improvements in aerobic capacity, endurance, and field exercise tests results. No significant adverse events were noted.

Conclusion: aerobic and resistance exercise programs are feasible and may be beneficial in cardiac patients with comorbid MG.

Keywords: Myasthenia Gravis (MG); Cardiac rehabilitation; Muscle weakness

Introduction

Myasthenia Gravis is an autoimmune neuromuscular disease characterized most commonly by antibodies to the postsynaptic acetylcholine receptors, resulting in weakness exacerbated by repetitive movement. Research on safety and feasibility of structured exercise in MG patients is scarce. No consensus guidelines exist on recommended intensity, duration or optimal frequency of exercise sessions. At the same time, benefits of exercise are well established for patient with coronary artery disease. Exercise-based cardiac rehabilitation programs consistently show reduction in cardiovascular mortality [1].

Whether the benefits of exercise in patients with comorbid MG and CAD (Coronary Artery Disease) outweigh the risks, remains unclear. To the best of our knowledge, no published reports on cardiac rehabilitation in patients with MG exist. Limited available studies on otherwise healthy MG patients yield conflicting results and provide little further guidance for a clinical exercise professional involved in the care of MG/CAD patients. Rahbek et al. reported no significant improvements in VO2 max or six-minute walk test results in MG patients following twenty aerobic training (AT) sessions [2].

Of further concern, a decline in muscular strength and an adverse change in MG-QOL15 (Myasthenia Gravis Quality of Life) scores were reported in the aerobically trained. Slightly more promising results were shown in patients who underwent resistance training. However, resistance training is not recommended as a primary exercise modality for patients undergoing cardiac rehabilitation. On the other hand, Westerberg's et al. study showed that aerobic training may be safe and effective for MG patients [3].

However, transferability of these results may be limited due to a small sample size and most enrolled participants with mild MGFA1-2 disease. Importantly, the study design did not include direct VO2peak assessment, while VO2peak improvement is the principal outcome measure of cardiac rehabilitation programs and the most important predictor of all-cause mortality. Moreover, the intervention in the study included two-minute exercise intervals at unspecified high intensity, which is not consistent with current general guidelines for cardiac rehabilitation for MI patients. Prescribing exercise to a MG patient in cardiac rehabilitation setting presents a unique challenge to a clinician.

Current CR guidelines call for twenty-sixty minutes of AT at 40-80% VO2R with single bouts of >ten minutes, supplemented by flexibility and strength training. Forty minutes of high-intensity training has been shown to yield additional benefits [4]. The repetitive nature of ten-minute bouts at moderate-high intensity may be contraindicated to MG patients. Designing an exercise program for an MG patient recovering from STEMI that would provide sufficient stimulus to improve cardiovascular function without significantly exacerbating neuromuscular symptoms presents an extreme challenge.

Case Report

A 70-year-old male status post STEMI and PCI to proximal LAD with severe LV dysfunction was referred for cardiac rehabilitation. The patient had fifteen-year history of generalized MG, MGFA2 (Myasthenia Gravis Foundation of America Classification), Anti-AChR (+), s/p thymectomy. Other significant co-morbidities included Type 2 Diabetes Mellitus, Obesity, Hypertension and Hypothyroidism.

His medication regimen included Aspirin 81 mg daily, Atorvastatin 80 mg daily, Tamsulosin 0.4 mg daily, Immune Globulin Intravenous 110 grams once a month, Glimepiride 2 mg twice a day, Sitagliptin 100 mg daily, Empagliflozin 25 mg daily, Lisinopril 10 mg daily, Metoprolol 50 mg daily, Clopidogrel 75 mg daily, Metoclopramide 5 mg three times a day, Pyridostigmine 60 mg and Levothyroxine 50mcg daily, and remained unchanged through the duration of exercise program.

A baseline assessment included a CPET (Cardio-Pulmonary Exercise Test) that showed VO2peak of 11.4 ml/kg/min (53% predicted), Peak Power of 65W and Anaerobic Threshold of 66% VO2peak. Additionally, a 6-minute walk test was administered and showed a distance of 226m (49% predicted). A 30sec Chair Stand Test showed a result of 11 repetitions. Baseline depression score was accessed with Patient Health Questionnaire-9 (PHQ-9), along with baseline quality of life (QOL) with a Dartmouth Cooperative Functional Assessment Charts (Dartmouth-COOP) test. A mid-program reassessment was planned to ensure no significant exercise-induced functional regression occurred that would warrant program discontinuation.

Treatment and Outcome

Sixty-minute exercise sessions were scheduled three days a week. We hypothesized that shorter bout of exercise with alternating modalities engaging upper/lower extremities may be less likely to induce significant neuromuscular adverse events. Training was initiated with five-minute bouts of exercise at 40% VO2peak, alternating between recumbent cycle, upper body ergometer and treadmill to a total of 6 bouts, not including warm up and cool down. Aerobic training was supplemented by flexibility exercise.

Additionally, resistance training with free weights was introduced on week two at 40% 1RM and fifteen repetitions. The patient was advised to alternate days of engaging in resistance and aerobic exercise. Additionally, bouts of aerobic exercise were separated by bouts of resistance exercise to avoid exercise-induced hyperthermia. The training regimen was reassessed every 2 weeks with gradual progression of both intensity and duration up to 75% VO2 peak and 15 min bouts of continuous exercise. The patient's EKG was monitored via telemetry.

In addition, BP and SPO2 were assessed pre- during- and post-exercise, as well as rating of perceived exertion on each exercise modality. A 6 min walk test and 30 sec Chair Stand test was repeated mid-program, showing significant progress and allowing for program continuation. The patient completed a total of 36 training sessions over a course of four months. All of the postponed exercise sessions were due to personal/scheduling issues. Overall, no significant adverse events were noted with the exception of three episodes of mild post-exercise ptosis and slight fatigue that resolved within 5-10mins of seated rest. No significant arrhythmias or signs of ischemia were noted during exercise sessions. BP remained within acceptable limits and the patient was able to maintain SPO2>96% on room air throughout his exercise sessions. Following completion of the program, the patient was referred for a repeat CPET that showed VO2Peak of 13.1 ml/kg/min, Peak Power of 71W and Anaerobic Threshold of 80%. Spirometry showed a marked improvement in Forced vital capacity (FVC) and Forced expiratory volume (FEV1), compared to baseline.

Of note: an incremental exercise protocol was performed during the last rehabilitation session and the patient was able to reach maximum power output of 100W, using a 10 W/min protocol (compared to 5W protocol used during CPET). In addition, the six-minute walk test was repeated showing a marked improvement compared to baseline (441 m, 95% predicted). The patient was able to achieve twenty repetitions on the 30sec Chair Stand administered on the last day of the program. Baseline and outcome measures are presented in Table 1.

	Baseline	Mid-Program	Post-Intervention
V02Peak	11.4 ml/kg/min	-	13.1 ml/kg/min
Peak Power	65W	-	71W
Anaerobic Threshold	66%	-	80%
6MWT	226m	375m	441m
30-sec Chair Stand	11 repetitions	15 repetitions	20 repetitions
Forced vital capacity (FVC)	2.74 L (70% predicted)	-	3.92L(79%predicted)
Forced expiratory volume (FEV1)	2.15L (75% predicted)	-	2.50L(87%predicted)
PHQ9	1	-	3
Dartmouth-COOP	23	-	21

Table 1: Baseline and Outcome values

Discussion

Safely exercising MG patients with concurrent cardiovascular disease presents unique challenges. Myasthenia Gravis is a rare debilitating disease with extremely limited research available on feasibility of aerobic and resistance training even in patients with no significant co-morbidities. Patient with MG are frequently discouraged from enrolling in cardiac rehabilitation by their healthcare providers or denied care at rehabilitation centers not equipped for care of such patients. Our report shows that aerobic and resistance exercise may be safe and effective for MG patients in a cardiac rehabilitation setting. Careful individualized planning; close monitoring and frequent reassessments are warranted to ensure that the benefits of training outweighing the risks associated with exercise in MG patients.

A pronounced difference in peak power output achieved during the last day in rehabilitation compared to repeat CPET may support that notion of shorter, higher intensity exercise bouts being more appropriate to prevent excessive repetitiveness and muscular fatigue. Although a marked improvement in our patient may be attributed to the dynamic nature of MG symptoms, other authors have reported improvements in V02peak (Peak Oxygen Uptake) following AT in an MG patient [5]. Moreover, Scheer et al. have reported a case of a patient with mild generalized MG successfully completing an ultra-endurance event [6].

Conclusion

Further research is warranted on safety and feasibility of exercise in MG patients, optimal frequency, intensity and progression. Patients should be considered for rehabilitation programs on a case-by-case basis pending further research.

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