CASE REPORT

BALANCING PRECISE AND SAFE EXERCISE IN MYASTHENIA GRAVIS WITH LOW CARDIORESPIRATORY ENDURANCE, CHEST EXPANSION LIMITATION, AND OBESITY

Veronika Renny Kurniawati1, Clarissa[1], Tresia Fransiska Ulianna Tambunan[2]
[1] Physical Medicine and Rehabilitation Department, Faculty of Medicine Universitas Indonesia, Cipto Mangunkusumo Hospital, Indonesia
[2] Physical Medicine and Rehabilitation Department, Faculty of Medicine Universitas Indonesia, Universitas Indonesia Hospital, Indonesia

ABSTRACT

Introduction: Myasthenia gravis is an autoimmune disorder affecting the neuromuscular junction, characterized by fluctuating muscle weakness and fatigability. Exercise is considered safe in mild to moderate disease; however, prescription must be individualized, particularly in patients with cardiorespiratory limitations and obesity. **Case Illustration:** A 38-year-old woman with myasthenia gravis presented with fatigue during activities of daily living. She had a history of myasthenic crisis, mechanical ventilation, and thymectomy. At evaluation, she demonstrated class II obesity (BMI 36.5 kg/m²), reduced exercise capacity (6MWT 285 m; 3.49 METs), limited chest expansion, and mixed obstructive–restrictive ventilatory impairment. A structured pulmonary and physical rehabilitation program was initiated, including breathing exercises, chest mobility training, and aerobic exercise (40–50% HRR), along with energy conservation strategies. **Discussion:** Fatigue was predominantly peripheral, related to impaired neuromuscular transmission. Pulmonary dysfunction was multifactorial, involving respiratory muscle weakness, obesity-related restriction, and airway limitation. Following two weeks of rehabilitation, objective improvements were observed, including increased peak cough flow (PCF) (210→230 L/min), peak expiratory flow rate (PEF) (190→270 L/min), and single-breath count (SBCT) (37→45), along with improved chest expansion. These findings reflect enhanced ventilation, airway clearance, and respiratory muscle performance. **Conclusion:** Individualized exercise prescription, combined with respiratory rehabilitation, is safe and effective in myasthenia gravis with cardiorespiratory limitation. Comprehensive management, including obesity intervention, is essential to optimize functional outcomes and quality of life.

Keywords: Myasthenia Gravis, Exercise Tolerance, Obesity

ABSTRAK

Pendahuluan: Myasthenia gravis adalah penyakit autoimun yang mengenai neuromuscular junction, ditandai dengan kelemahan otot fluktuatif dan kelelahan. Latihan bersifat aman pada derajat penyakit ringan hingga sedang, tetapi peresepannya bersifat individual, terutama pada keterbatasan kardiorespirasi dan obesitas. Ilustrasi **Kasus:** Perempuan, 38 tahun dengan myasthenia gravis dengan keluhan lelah saat aktivitas sehari-hari. Terdapat riwayat krisis myasthenia, ventilasi mekanik, dan timektomi. Status gizi obesitas grade II (IMT 36,5 kg/m²), terdapat penurunan kapasitas latihan (6MWT 285 m; 3,49 METs), keterbatasan pengembangan dada, dan gangguan ventilasi campuran obstruktif-restriktif. Rehabilitasi paru dan fisik terstruktur telah diberikan, termasuk latihan pernapasan, mobilitas dada, dan aerobic (40-50% HRR), disertai strategi konservasi energi. **Diskusi:** Kelelahan dominan bersifat perifer, terkait dengan gangguan transmisi neuromuskular. Disfungsi paru bersifat multifaktorial, mencakup kelemahan otot respirasi, restriksi terkait obesitas, dan limitasi jalan napas. Setelah dua minggu rehabilitasi, terdapat peningkatan objektif, termasuk arus puncak batuk (210→230 L/min), laju aliran ekspirasi puncak (190→270 L/min), single breath count test (SBCT) (37→45), dan ekspansi dada. Hal ini menunjukkan peningkatan ventilasi, bersihan jalan napas, dan performa otot respirasi.

Kesimpulan: Peresepan latihan individual dikombinasikan dengan rehabilitasi paru bersifat aman dan efektif pada myasthenia gravis dengan keterbatasan kardiorespirasi. Manajemen komprehensif, termasuk intervensi obesitas, penting untuk mengoptimalkan luaran fungsional dan kualitas hidup.

Kata kunci: Myasthenia Gravis, Toleransi Latihan, Obesitas

Correspondence :
Veronika Renny Kurniawati
Physical Medicine and Rehabilitation Department, Faculty of Medicine Universitas Indonesia, Cipto Mangunkusumo Hospital, Indonesia, Jl.Diponegoro no. 71 Jakarta Pusat
telp. 087857355235
email: veronikarennykurniawati@gmail.com

How to cite this article :

BALANCING PRECISE AND SAFE EXERCISE IN MYASTHENIA GRAVIS WITH LOW CARDIORESPIRATORY ENDURANCE, CHEST EXPANSION LIMITATION, AND OBESITY

INTRODUCTION

Myasthenia gravis is an autoimmune disorder that affects the neuromuscular junction, particularly the acetylcholine receptors. This condition leads to fluctuating muscle weakness with variable severity. In its most severe form, myasthenia gravis can progress to generalized muscle weakness and respiratory failure, often necessitating mechanical ventilation and carrying a risk of mortality. Management requires a comprehensive approach, including both pharmacological and non-pharmacological strategies, particularly physical and cardiopulmonary rehabilitation. The safety of physical rehabilitation has been demonstrated in multiple studies, especially in patients with milder disease, even at relatively higher exercise intensities. Nevertheless, exercise prescription must be individualized based on the patient's clinical condition.[1–3]

CASE REPORT

A 38-year-old female was consulted to the Physical Medicine and Rehabilitation Department with a chief complaint of fatigue during household activities. The symptoms began in May 2023, initially presenting as ptosis, which subsequently progressed to generalized muscle weakness, which were more pronounced in the upper than lower extremities. She presented to the hospital, underwent some examinations including confirmation of acetylcholine receptor antibodies identification. The patient was diagnosed with myasthenia gravis, for which she was treated with pyridostigmine bromide and corticosteroids. Her symptoms initially improved, and she regained independent ambulation.

Two months after the diagnosis, she developed an episode of severe weakness that was accompanied by dyspnea, requiring admission to the intensive care unit (ICU) and mechanical ventilation. She received intravenous immunoglobulin therapy, which resulted in improvement of both dyspnea and muscle weakness, although dysphagia persisted. A thoracic computed tomography (CT) scan revealed a thymoma, and thymectomy was subsequently recommended.

Following thymectomy in December 2023, she underwent 28 sessions of radiotherapy (completed in November 2024) and continued pyridostigmine therapy. She continued to experience fluctuating limb weakness and intermittent ptosis; however, she was able to tolerate oral intake without choking and perform basic activities of daily living, including toileting, washing, and ambulation, with minimal assistance from her husband.

Between November 2024 and March 2026, the frequency of fluctuating weakness decreased; however, she reported dyspnea during household activities (e.g., sweeping and mopping), brisk walking, and independent self-care tasks such as bathing and meal preparation. She was able to complete these activities with limitations, and her symptoms improved with rest. At the time of evaluation, she was taking pyridostigmine 60 mg six times daily, with symptomatic improvement typically occurring within two hours after administration.

The patient had a history of asthma since the younger age, with infrequent exacerbations and no prior use of maintenance or rescue medications. At the time of presentation to the PM&R clinic, she reported a one-week history of upper respiratory symptoms, including productive cough with effective expectoration. She was able to ambulate independently for a maximum distance of approximately 1 km at a slow pace, requiring 4–5 rest periods due to fatigue and dyspnea. She was a housewife with no children and expressed a desire to engage in regular physical exercise, such as jogging, as her motivation to continue therapy.

On physical examination, vital signs were within normal limits. She was classified as having class II obesity, with a body weight of 90 kg, height of 157 cm, and body mass index (BMI) of 36.5 kg/m^2. Thoracic examination revealed symmetrical chest expansion, with measurements of 4–4–5 cm. Breath sounds were normal, with no crackles, rhonchi, or wheezing on auscultation. The single-breath count was 37. Peak expiratory flow rate (PEF) was 190 L/min, and peak cough flow (PCF) was 210 L/min.

Functional capacity assessment using the 6-minute walk test (6MWT) demonstrated a total distance of 285 meters, with an estimated maximal oxygen consumption (VO_2max) of 12.2 mL/kg/min, corresponding to 3.49 metabolic equivalents (METs). Borg scale scores (fatigue–dyspne–leg fatigue) increased from 9–2–2 pre-test to 15–4–5 post-test. The one-minute sit-to-stand test yielded 34 repetitions, with a post-test Borg score of 12–1–2. Handgrip strength was 15.4 kgf on the right and 15.2 kgf on the left. The Fatigue Severity Scale score was 47, indicating significant perceived fatigue.

Spirometry performed in January 2025 demonstrated a forced expiratory volume in 1 second (FEV_1) of 59% predicted, forced vital

capacity (FVC) of 63% predicted, and an FEV_1/FVC ratio of 80.3%. Follow-up spirometry in March 2026 showed a mixed obstructive and restrictive pattern, with FEV_1 of 52% predicted, FVC of 59% predicted, and an FEV_1/FVC ratio of 93%. A thoracic computed tomography (CT) scan in December 2025 showed no residual mediastinal lesion or pulmonary pathology. Laboratory investigations revealed elevated erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) levels. Anti–acetylcholine receptor antibodies were positive.

The patient was prescribed a structured pulmonary and physical rehabilitation program. Breathing exercises included diaphragmatic breathing and incentive spirometry using a three-flow device, performed at 5 repetitions per set for 5 sets daily. Pursed-lip breathing was instructed during activities as a compensatory strategy. To address limited chest expansion, she was prescribed chest mobility exercises and self-assisted manual air stacking, followed by the active cycle of breathing technique (ACBT).

Aerobic exercise was initiated using a supervised lower-limb ergocycle at an intensity of 40–50% heart rate reserve (HRR), corresponding to a target heart rate of 114–125 beats per minute. A home-based aerobic program was also prescribed, consisting of moderate-intensity walking for 20–30 minutes, 3–5 times per week, monitored using the talk test and a maximum rating of perceived exertion (RPE) of 13.

The patient was educated on energy conservation strategies and environmental modifications for activities of daily living, including activity pacing, performing household tasks in a seated position, and using a shower for bathing. At the two-week follow-up, the patient reported reduced fatigue and was able to bathe independently without significant symptoms. She was able to perform sweeping and mopping on alternating days. Her walking tolerance improved to 200 meters at a normal pace before requiring rest due to fatigue. Objective measures showed improvement, with peak expiratory flow rate (PEF) increasing to 270 L/min, peak cough flow (PCF) to 230 L/min, and single-breath count (SBC) to 45. Chest expansion improved by 1 cm, from 4–4–5 cm to 4–4–6 cm.

Tabel 1. Comparison Baseline Functional Parameters and Two Weeks After Rehabilitation

Parameters	Before Program	Two Weeks After Program
SBCT	37	45
PFR	190	270
PCF	210	230
Chest Expansion	4-4-5 cm	4-4-6 cm
6 minute walk test	285 m	340 m (predicted from 1-minute sit to stand test)

DISCUSSION

Myasthenia gravis in this patient was considered clinically stable under pyridostigmine therapy (60 mg, six times daily). Fatigue was fluctuating in nature and typically occurred during physical activities exceeding her usual intensity. During more strenuous exertion, fatigue was occasionally accompanied by mild dysarthria, which improved with rest and subsequent pyridostigmine administration. Fatigue perception, assessed using the Fatigue Severity Scale, indicated significant fatigue. In myasthenia gravis, autoantibodies against acetylcholine (ACh) receptors impair neuromuscular transmission, resulting in fluctuating muscle weakness and fatigability. In this patient, anti–ACh receptor antibodies were positive, supporting a peripheral mechanism of fatigue due to reduced effective neuromuscular transmission. Although fatigue may also have a central component influenced by psychological factors such as motivation and mood, her good motivation and adherence to exercise suggest that peripheral fatigue predominated.

Spirometry demonstrated a mixed obstructive and restrictive pattern, indicating both reduced airflow and impaired lung volumes. Compared with spirometry performed one year earlier, there was a decline in pulmonary function, suggesting that sedentary behavior, obesity, and respiratory muscle weakness may have interacted to reduce functional capacity over time. Given the progressive nature of the disease and associated deconditioning, timely intervention is essential to prevent further decline.

Limited chest expansion in this patient was likely multifactorial, resulting from respiratory muscle weakness compounded by increased abdominal adiposity, which further restricts diaphragmatic excursion. In addition, mucus retention associated with recent respiratory infection may have contributed to microatelectasis and air trapping. Airway involvement, possibly related to respiratory muscle weakness, may explain the obstructive component observed on spirometry. These combined factors contribute to impaired ventilation and oxygenation, which in turn exacerbate exercise-induced fatigue, particularly in the extremities.[4,5]

Breathing interventions, including chest mobility exercises and self-assisted manual air stacking, were prescribed to improve chest expansion and lung recruitment. Improvements in chest expansion, single-breath count (SBC), peak cough flow (PCF), and peak expiratory flow rate (PEFR) following intervention indicate a favorable response and support continuation of the rehabilitation program.

To further optimize ventilation and reduce hypoxemia, respiratory muscle training was implemented using both non-device-based and device-assisted approaches. Diaphragmatic breathing was emphasized as a primary strategy for strengthening the diaphragm. Incentive spirometry was also utilized; however, due to the use of a three-flow device with approximate volume indicators (600, 900, and 1200 mL), exercise intensity was prescribed based on repetition rather than precise volume measurement. The patient performed 5 sets of 5 inspiratory repetitions. Additionally, pursed-lip breathing was taught as a compensatory technique to reduce air trapping and dyspnea during activities, particularly in the presence of an obstructive ventilatory component.[4,6]

Exercise prescription in myasthenia gravis must prioritize safety, as excessive intensity may precipitate exercise-induced fatigue or exacerbation. Baseline functional capacity was assessed using the 6-minute walk test to guide individualized exercise intensity. Aerobic training was initiated at 40–50% of heart rate reserve (HRR), with additional monitoring using a rating of perceived exertion (RPE) not exceeding 13 and close observation for symptoms of exacerbation, including prolonged fatigue not resolving after at least two hours of rest.[7]

In this case, improving exercise tolerance and ensuring safety were prioritized over immediate weight reduction.[4] The patient's class II obesity (BMI 36.5 kg/m²) likely contributed significantly to her pulmonary dysfunction through both restrictive and obstructive mechanisms. Excess adipose tissue, particularly in the abdominal and thoracic regions, reduces chest wall compliance and limits diaphragmatic excursion, resulting in decreased lung volumes such as functional residual capacity (FRC) and expiratory reserve volume (ERV), thereby producing a restrictive ventilatory pattern. In addition, obesity is associated with increased airway resistance due to reduced lung volumes, which promote airway narrowing and closure, particularly in the small airways, contributing to an obstructive component. Mechanical loading of the respiratory system also increases the work of breathing and may impair respiratory muscle efficiency, especially in the presence of underlying neuromuscular weakness such as myasthenia gravis. Furthermore, obesity is a recognized risk factor for conditions such as obstructive sleep apnea, which can exacerbate nocturnal hypoventilation and gas exchange abnormalities. These combined effects likely contributed to the mixed obstructive–restrictive pattern observed on spirometry and to the patient's reduced exercise tolerance and dyspnea. Therefore, comprehensive and well-structured management of obesity, which was through weight management with dietary modification, emphasizing caloric balance and increased physical activity, avoidance of a sedentary lifestyle, and collaboration with a clinical nutritionist is essential to optimize pulmonary function and improve overall clinical outcomes. Given the increased energy expenditure associated with obesity, exercise prescription was individualized in terms of intensity and frequency. Nevertheless, weight reduction remains an important long-term goal due to its association with metabolic syndrome and increased risk of obstructive sleep apnea (OSA). OSA may contribute to nocturnal hypoventilation, impaired carbon dioxide elimination, and further reduction in oxygenation, thereby exacerbating fatigue and reducing quality of life. Although obesity may increase the risk of relapse and readmission, protective factors in this patient—such as younger age at onset, early thymectomy, and corticosteroid therapy—may mitigate this risk.[1,8]

Based on the 6-minute walk test, the patient's functional capacity was approximately 3.5 metabolic equivalents (METs), indicating the need to divide daily activities into shorter, manageable sessions while becoming her role as a housewife doing household activities. Safe activity levels can be guided by standardized compendia of physical activities. Energy conservation strategies were therefore recommended to reduce the risk of activity-induced fatigue and exacerbation of myasthenia gravis.

CONCLUSION

Exercise prescription in myasthenia gravis patients should be individualized according to each patient's clinical condition and functional capacity. Current evidence suggests that exercise is safe in patients with mild to moderate disease. At the initial stage, exercise should be introduced at low intensity with careful monitoring for signs

and symptoms of exercise-induced fatigue and disease exacerbation. Gradual improvement in exercise capacity may enhance quality of life and help mitigate disease progression and associated complications.

REFERENCES

1. Habib AA, Sacks N, Cool C, Durgapal S, Dennen S, Everson K, et al. Hospitalizations and Mortality From Myasthenia Gravis. Neurology. 2024 Jan 23;102(2). doi:10.1212/WNL.0000000000207863
2. Kara F, Göl MF, Boz C. Evaluation of clinical features and prognosis of myasthenia gravis in adults based on the age of onset: A retrospective study from a single center of 30 years MG registry. Neurol Asia. 2022 Dec;27(4):981–9. doi:10.54029/2022ich
3. Dresser L, Wlodarski R, Rezania K, Soliven B. Myasthenia Gravis: Epidemiology, Pathophysiology and Clinical Manifestations. J Clin Med. 2021 May 21;10(11):2235. doi:10.3390/jcm10112235
4. Gilhus NE. Physical training and exercise in myasthenia gravis. Neuromuscular Disorders. 2021 Mar;31(3):169–73. doi:10.1016/j.nmd.2020.12.004
5. Tambunan T, Crisdayani C. Myasthenia gravis with exercise intolerance, low cardiorespiratory and muscle endurance. Indonesia Journal Chest. 2021;8(2):59–64.
6. Gilhus NE. Myasthenia gravis, respiratory function, and respiratory tract disease. J Neurol. 2023 Jul 26;270(7):3329–40. doi:10.1007/s00415-023-11733-y
7. Corrado B, Giardulli B, Costa M. Evidence-Based Practice in Rehabilitation of Myasthenia Gravis. A Systematic Review of the Literature. J Funct Morphol Kinesiol. 2020 Sep 27;5(4):71. doi:10.3390/jfmk5040071
8. Singh T, Savani C, Kumar varun, Schutt C, Amin S, Suradi Y, et al. Incidence and Predictors of readmission in patients with Myasthenia Gravis: A National population-based cohort study (2010–14). (P5.4-023). Neurology. 2019 Apr 9;92(15_supplement). doi:10.1212/WNL.92.15_supplement.P5.4-023