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Case Report

Efficacy of Plasma Exchange in Myasthenia Gravis Following Long COVID in a Resource-Limited Context: A Case Report

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Abstract: This case report describes the development of myasthenia gravis (MG) in a 71-year-old male patient with long COVID and outlines the management of an MG exacerbation. The patient exhibited significant symptoms, including fatigue, cognitive impairment, dysphagia and dysarthria. Although transient improvement was observed after treatment with pyridostigmine, the patient's condition later worsened, with marked axial and buccopharyngeal weakness. Symptom relief was finally achieved with plasmapheresis using a low-volume crossflow gravity-driven method. This case highlights the potential long-term impact of COVID-19 on autoimmune disorders such as MG and emphasizes the need for vigilance in managing post-COVID neurological complications.

Keywords: Long COVID; Myasthenia Gravis; Plasma Exchange; Hemoclear.

1. Introduction

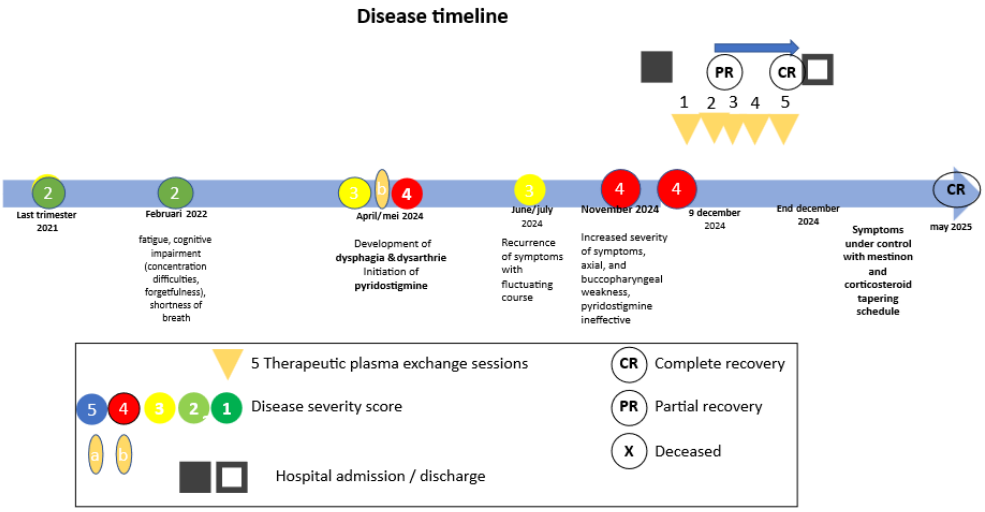
The COVID-19 pandemic has had profound effects on global health, with growing evidence indicating its potential to trigger or exacerbate autoimmune conditions [1], alongside emerging data on the clinical impact of long COVID. Myasthenia gravis (MG) is a chronic autoimmune neuromuscular disorder characterized by fluctuating muscle weakness and fatigue [2, 3]. Therapeutic Plasma Exchange (PLEX) has been utilized as an intervention for severe MG manifestations in post-COVID patients, particularly in cases of myasthenic crisis or significant disease exacerbation. PLEX functions by removing circulating autoantibodies, thereby reducing immune-mediated neuromuscular dysfunction [4]. This case report examines the influence of acute COVID-19 and subsequent long COVID on the clinical course of MG in a 71-year-old male patient.

2. Case Report

The patient, a 71year old male with no prior medical history before 2022, began experiencing symptoms in February 2022, including fatigue, cognitive impairment, specifically cognitive and exertional dyspnea. His initial SARS-CoV-2 infection occurred in the last trimester of 2021 (Figure 1). These symptoms progressively worsened over time. In

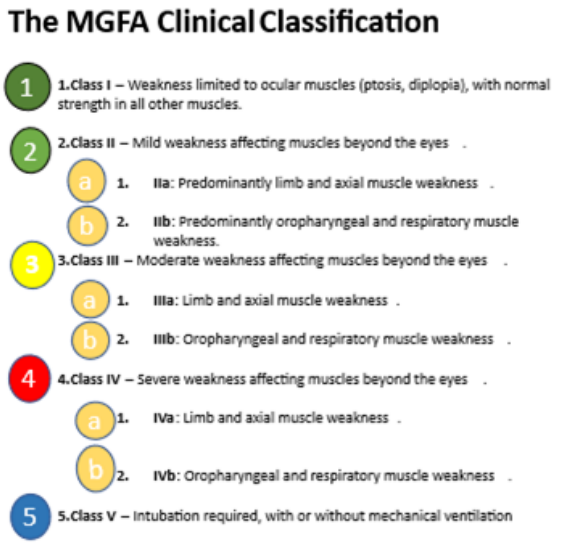
April 2024, the patient developed dysphagia and articulation difficulties, suggestive of MG, with bulbar involvement. A short-term improvement was noted with pyridostigmine treatment initiated in May 2024; however, symptoms soon recurred, displaying a fluctuating clinical course (Figure 1).

Figure 1. Timeline of Disease Progression, Treatment, and Recovery in Myasthenia Gravis.



A clinical diagnosis of MG, class 3b MFGA (Figure 2), was made at that time. By November 15, 2024, symptom severity had increased, prompting an escalation in pyridostigmine dosage, though without clinical benefit. Computed tomography and magnetic resonance imagination of the brain and chest showed no thymoma or other abnormalities. Neurological symptoms progressed including head drop (axial weakness), buccopharyngeal weakness, neck and left shoulder stiffnessand a single episode of diplopia. The patient denied paresthesia or muscle cramps but reported fecal incontinence with preserved urinary control. Plasma exchange (PLEX) by Hemoclear plasmapheresis (Hemoclear B.V, Zwolle, The Netherlands) [5] was initiated on November 30, 2024, as a bridging therapy to provide rapid symptom control.

Figure 2. Myasthenia Gravis Foundation of America (MGFA) Clinical Classification System.



Notable clinical improvement was observed during treatment. Prednisone was introduced following the second session, because Initiating PLEX first has been aimed at preventing clinical deterioration while mitigating potential steroid-induced worsening, which can occur in MG due to transient symptom exacerbation after starting high-dose steroids [6]. By the third plasmapheresis session, the patient demonstrated marked improvement in muscle and buccopharyngeal strength, with continued progress reported by the fifth session. Spirometry conducted on December 9, 2024, showed normal values. An electromyography (EMG) was not performed due to logistical constraints, and samples for antibody confirmation had to be sent abroad for definitive analysis. The MG diagnosis was retrospective serologically confirmed by the presence of positive acetylcholine receptor (AChR) antibodies with a concentration of 16.92 nmol/L at the time of admission to the medium care unit at the department of neurology.

3. Discussion

This case highlights the complex interplay between COVID-19 and autoimmune conditions such as MG. The patient initially exhibited signs consistent with long COVID: fatigue, cognitive impairment, concentration difficulties, forgetfulness, and shortness of breath. However, as the disease progressed, the emergence of bulbar symptoms—dysphagia and articulation difficulties suggested neuromuscular involvement more characteristic of MG rather than post-viral syndrome alone [7-10]. More than 20 published cases describe new-onset MG occurring within 5–60 days after SARS-CoV-2 infection, with a mean latency of approximately 23 days. Common initial symptoms include ocular manifestations such as ptosis and diplopia, or bulbar weakness, which can progress to generalized MG in more severe cases [7, 8].

Affected individuals, aged 21–83 years, typically have no prior history of MG [7, 8]. In more than 80% of these cases anti-acetylcholine receptor (AChR) antibodies are detected, while anti-muscle-specific kinase (MuSK) antibodies are rarely present [7, 8]. The pathogenesis of myasthenia gravis (MG) following SARS-CoV-2 infection may involve three interrelated immunological mechanisms. First, molecular mimicry is considered a central factor. Structural homology between specific epitopes on the SARS-CoV-2 spike protein and the acetylcholine receptor (AChR) at neuromuscular junctions may lead to the production of cross-reactive autoantibodies [7]. These antibodies, while targeting viral antigens, may erroneously bind to AChRs disrupting synaptic transmission and causing muscle weakness [7]. Second, emerging evidence implicates thymic dysregulation in post-COVID MG pathogenesis. SARS-CoV-2 infection may induce thymic hyperplasia or interfere with T-cell tolerance, promoting the survival of autoreactive T-cell clones [7, 8]. These clones may cooperate with B-cells to produce AChR-specific antibodies. This hypothesis is supported by histological findings of thymic abnormalities in post-COVID MG patients, even in the absence of radiological evidence of thymoma [7, 8].

Finally, the cytokine storm associated with severe COVID-19 may exacerbate autoimmune susceptibility. Excessive production of pro-inflammatory cytokines, such as IL-6 and TNF-α, can suppress regulatory T-cell function and activate autoreactive B-cells [8]. This pro-inflammatory environment may lower the threshold for MG onset in genetically predisposed individuals, particularly those carrying human leukocyte antigen (HLA) risk alleles [9]. The fluctuating nature of MG, as observed in this patient, underscores the need for continuous monitoring and adaptive treatment strategies. Recent clinical cases document the use of gravity-driven crossflow plasmapheresis, a technique employing natural gravitational forces for plasma filtration, as a viable alternative in low-resource settings where conventional plasmapheresis systems may not be available [11].

Comparative analyses of different plasma exchange techniques highlight key differences in efficiency, selectivity, and accessibility. Membrane-based filtration methods are advantageous due to their ability to selectively remove pathogenic immunoglobulins while preserving essential plasma proteins. In contrast, centrifugation-based plasma exchange is widely used but requires complex machinery, limiting its feasibility in resource-

constrained environments. Additionally, double-filtration plasmapheresis (DFPP) has demonstrated efficacy in autoimmune disorders by selectively removing specific antibody fractions, though its accessibility remains limited in low-income settings [12, 13]. The successful use of gravity-driven crossflow plasmapheresis in this case demonstrates its potential effectiveness in managing severe MG symptoms. Importantly, this case also illustrates that in low-resource settings, a multidisciplinary approach is essential for managing MG in the context of long COVID, addressing both the autoimmune and post-viral aspects of the disease.

4. Conclusion

The impact of COVID-19 on autoimmune conditions such as MG poses significant challenges for healthcare providers. This case report highlights the critical need to recognize and address the complex interplay between viral infections and autoimmune disorders. PLEX is an important treatment option and should be considered if MG is suspected or diagnosed. Optimizing patient outcomes requires a comprehensive and individualized treatment strategy tailored to the unique clinical course of each patient.

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Research Ethics Committee Approval: The patient provided written informed consent for participation, and the study was conducted in accordance with the ethical guidelines outlined in the Declaration of Helsinki.

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Conflicts of Interest: Arno P. Nierich is the inventor of the HemoClear filter and holds stock ownership in HemoClear BV, Ceintuurbaan 28, 8024 AA Zwolle, The Netherlands. He has not been involved in the clinical treatment of the patient described in this study. All other authors declare no conflicts of interest.

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