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CASE REPORT

Combating Respiratory Failure due to Myasthenia Crisis in an Area with Limited Resources: A Case Report

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ABSTRACT

Background: Myasthenia crisis is a complication of myasthenia gravis that is characterized by respiratory muscle weakness resulting in respiratory failure. This condition often requires intubation and mechanical ventilation. Myasthenia crisis is a complication of myasthenia gravis that is characterized by respiratory muscle weakness resulting in respiratory failure. An impending crisis may be presented by dyspnea and bulbar symptoms. The occurrence of these symptoms indicates immediate attention. **Objectives**: This paper reports an unusual case of myasthenia crisis in remote areas with limited management resources. **Case:** A patient with a history of myasthenia gravis was admitted with a chief complaint of dyspnoea two days prior to admission. Then, the patient's condition worsened until he was in a critical period due to loss of consciousness and respiratory failure. Intubation and mechanical ventilation were performed. The patient's condition gradually improved, and in the fourth week after admission, mechanical ventilation was discontinued, extubated and able to breathe spontaneously. Plasmapheresis was given afterward. **Conclusion:** Myasthenia crisis is a common complication of myasthenia gravis that requires immediate attention. Risk factors that trigger a crisis should be identified early so that the patient can be given immediate treatment if necessary. Either plasmapheresis or IVIG should be given as early as possible, depending on availability at the hospital.

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Highlights

1. Myasthenia crisis is a complication of myasthenia gravis that is characterized by respiratory muscle weakness resulting in respiratory failure.
2. Prompt identification and management of an impending crisis will result in clinical improvement and may be life-saving.

BACKGROUND

Myasthenia gravis (MG) is an antibody-autoimmune neurological disease with a transmission defect located at the neuromuscular junction (Dresser et al., 2021) that is treatable, and the mortality rate can be minimized by medical therapy. However, MG still affects patients' health-related quality of life (HRQoL) (Dong et al., 2020). The transmission defect involves the production of various types of antibodies (IgG) directed against the motor receptors in the postsynaptic membrane at the neuromuscular junction (Payus et al., 2021), causing the reduction of several extracellular antigens (acetylcholine receptors (Ach-R) or a muscle-specific tyrosine kinase (MuSK) (Murai, 2014), lipoprotein-related protein 4, agrin, titin, and ryanodine (Murai, 2014), low-density lipoprotein receptor-related protein 4 (Lrp4) (Dresser et al., 2021)), leading to poor stimulation and muscle fiber activation. MG is also known as a class II hypersensitivity reaction, so extracellular antigens can be used to define the categorization of the disease and delineate phenotypic variants (Dresser et al., 2021).

Until now, the diagnosis and medical management of MG are still challenging (Catalin et al., 2018). The disease is characterized by transient or persistent weakness and fatigue of ocular, bulbar, limb, trunk, respiratory, or voluntary (skeletal) muscles (Catalin et al., 2018; Heitmiller, 1999), that alleviated after rest (Sykalo et al., 2019). Other symptoms include difficulty in swallowing and breathing (Dong et al., 2020). The weakness affects the striated muscle, but along with the disease course, it involves the extraocular muscles and/or the levator palpebrae. While eye symptoms including the weakness on orofacial, bulbar, limb, neck, and/or respiratory muscles (de Paula Estephan et al., 2022). The facial appearance of MG patients were sleepy, expressionless, or sad due to ptosis and facial weakness (Catalin et al., 2018).

The incidence of MG ranges from 0.3 to 2.8 per 100,000 people (Sykalo et al., 2019) But compared with before 1976, the incidence after 1976 was lower (6.5 vs. 3.5) (Bubuioc et al., 2021). The incidence is higher in females compared to males (Wendell and Levine, 2011) in the 20–30s, yet higher on male in the 60-80s age range (Payus et al., 2021). Others found MG affecting individuals at any stage and age, but the peak frequency was found at 20- 40, dominated by females, and those>50 years old tend to affects male (Samih and Ahami, 2019). However, several studies found a similar proportion between males and females (Beland et al., 2024)(Wilcke et al., 2023). It is believed that up to 10% to 20% of MG patients will experience at least 1 crisis in their lifetime (Sykalo et al., 2019). MG was categorized to facilitate the therapeutic process and estimate the prognosis based on the clinical presentation and seropositivity (Bubuioc et al., 2021) into two clinical forms, which are ocular MG that is limited to the eyelids, affecting 90% of patients (Catalin et al., 2018), extraocular muscles (EOM), and generalized myasthenia gravis (gMG). The extraocular muscles is the most common type of MG, found in two-thirds of patients, while gMG counts for 10% (Murai, 2014) involving a combination of limb, bulbar, and respiratory muscles (Payus et al., 2021).

Medical management for MG including acetylcholinesterase (AChE) inhibitors and β-adrenergic agonists, grouping on non-immunosuppressive treatments; immunosuppressive treatments (Corticosteroids, Azathioprine, Tacrolimus, Mycophenolate Mofetil, Cyclosporine, Methotrexate, Cyclophosphamide, and Hematopoietic Stem Cell Transplantation (HSCT); monoclonal antibodies targeting immune system (Rituximab, Eculizumab, Efgartigimod); treatment during severe MG or crisis (Intravenous Immunoglobulin (IVIg) and Plasma Exchange (PLEX)); and thymectomy (Alhaidar et al., 2022). Meanwhile, a systematic review described the medical management, including first-line

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treatment (Pyridostigmine, Prednisolone, Thymectomy), second-line treatment (Azathioprine, Cyclosporine, IVIG), third-line treatment (Methotrexate, Mycophenolate mofetil, Plasmapheresis), fourth-line treatment (Rituximab) and fourth-line treatment (Eculizumab , Cyclophosphamide) (Farmakidis et al., 2018). The therapy depends on the MG-related antibody (De Bleecker et al., 2024). Myashenic crisis (MC) is experienced at least once by 15–20% of MG patients (Wendell and Levine, 2011), other found 20-30% (Godoy et al., 2013). It is defined as constellation of clinical conditions characterized of bulbar-innervated muscles or respiratory muscle weakness resulting on breath difficulties or speech ability within a few days or more, or a few hours so that the patients needing supportive treatment and hospitalization (intubation or ventilation, supportive feeding (Schroeter et al., 2018) along with high dose corticosteroids in combination with plasma exchange or IVIG (Chaudhuri and Behan, 2009). So, MC were characterized by the worsening on muscle weakness, resulting in respiratory failure (Godoy et al., 2013) due to obstruction and aspiration. It is a is a life-threatening complication experiencing by one-fifth patients during the first year of disease (Juel, 2004), with the mortality of 2-3% (Schroeter et al., 2018), not because of MC, but comorbidity or complications (Wendell and Levine, 2011). During this crisis, the treatment targeting the inciting event and airway support, including the usage of corticosteroids and respiratory support such as positive pressure ventilation or intubation when needed (Roper et al., 2017). An impending crisis might be presented by dyspnea, bulbar symptoms, or both together (Wendell and Levine, 2011). The occurrence of these symptoms indicates immediate attention (Sykalo et al., 2019).

OBJECTIVE

This paper reports an unusual case of myasthenia crisis in remote areas with limited management facilities.

CASE

A thirty-three-year-old male with a history of MG was admitted to the Emergency Department with a chief complaint of shortness of breath for 2 days prior to admission. The patient reported a 1-year medical history of MG on regular daily oral pyridostigmine without dose adjustment by a physician. Two weeks prior to admission, the patient suffered from a common cold and progressive weakness in all four extremities.

Table 1. Routine laboratory results at the emergency department

Laboratory Examination	Value
Haemoglobin	16.5 g/dL
Haematocrit	47.7%
White Blood Count	11.020 x 109/L
Blood Sugar	137 mg/dL
SGOT	45 U/L
SGPT	157 U/L
Urea	15mg/dL
Creatinine	0.91 U/L
Natrium	140 mmol/L
Kalium	4.1 mmol/L
Chloride	101 mmol/L
Albumin	3.28

Vital signs were within normal limits, except for a slightly elevated temperature (37.5°C) and decreased

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SpO_2 (93%). The patient was fully conscious and able to breathe spontaneously. Physical examination was within normal limits, with no bulbar weakness, but there was weakness in all four extremities. Motoric strength examination in both his upper and inferior extremity got 3-4 out of 5. Initial blood tests showed slightly elevated white blood cells and liver function tests. The patient was then transferred to the ICU for close monitoring for possible impending crisis.

She was initially treated with high-dose steroids, IV Methylprednisolone 125 mg every 8 hours and Pyridostigmine every 6 hours, without plasmapheresis or IVIG due to limitations of the hospital. Two days after admission, the patient's condition deteriorated. He became anxious with worsening respiratory distress. He was in critical condition due to loss of consciousness with respiratory failure and required emergent intubation. We immediately intubated the patient without premedication and connected him to mechanical ventilation to support his breathing. A blood gas analysis test was performed, and it showed type 2 respiratory failure with high pCO_2.

Table 2. Blood gas analysis

pH	**7.205**	**STEP 1**	**60.77 - Consistent**
PCO2	86.6	STEP 2	Acidosis
TCO2	37	STEP 3	Respiratory acidosis
PO2	163	STEP 4	Superimposed metabolic alkalosis
HCO3	34.2	STEP 5	Anion gap not measured
So2	99	STEP 6	In accordance with clinical appearance
	Conclusion		Respiratory acidosis, inadequate compensation with superimposed metabolic alkalosis

The patient's condition gradually improved in the second week. However, he presented with fever and cough. Chest X-ray evaluation suggested pneumonia, so the patient was given symptomatic treatment and IV antibiotics. His condition improved after he completed one week of IV antibiotics. After passing the spontaneous breathing trial, the patient was finally extubated and disconnected from mechanical ventilation in his third week after admission. The patient was able to breathe spontaneously and continued to be monitored in the ICU for several days before being transferred to the general ward, where manual plasmapheresis was performed thereafter.

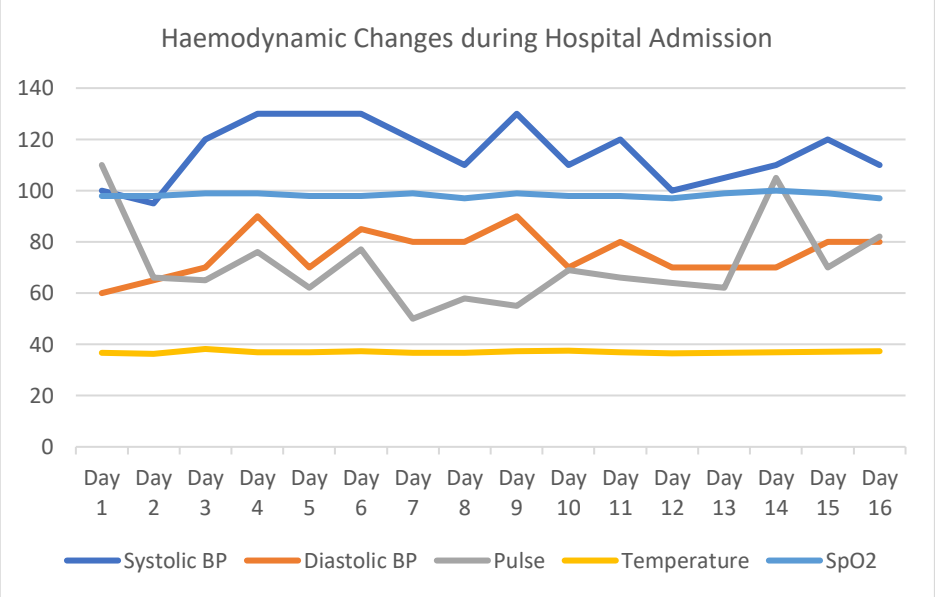

Figure 1. Haemodynamic changes during hospital admission

DISCUSSION

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Patients with MG who develop respiratory symptoms must be closely monitored in the ICU, as it may be a sign of impending crisis, and it seems respiratory failure is one of the presenting forms of MG (Venkataramaiah and Kamath, 2019). Similar to other autoimmune diseases, MG was predominant in young adult females (Wolf et al., 1966) or before the age of 40, but reverses after the age of 50. However, the disease is not age-specific (Li, 2016). MG management aims to control the symptoms and minimize the manifestations or achieve remission, including the prescription of acetylcholinesterase inhibitors (AChEI). Pyridostigmine is an AChEI that is commonly prescribed for mild MG (Farrugia and Goodfellow, 2020). However, excessive intake of AChEI leads to cholinergic crisis (CC) with similar symptoms to MC, but CC is rarely diagnosed (Prado and Adiao, 2021). The prescription of pyridostigmine in this patient has been in line with the recommendation as the first-line treatment (Farmakidis et al., 2018). However, due to regular intake without further adjustment, the possibility of CC can't be excluded, as at very high doses it can increase weakness with respiratory insufficiency (Farmakidis et al., 2018).

But, the diagnosis of MC was determined due to the presence of respiratory infection. Most cases of MC can be triggered by respiratory tract infection (Godoy et al., 2013) In line with the patient's condition, she had a common cold, including a cough 2 weeks prior to admission that got worse over time. Other than infections, the initiation of steroids and medication intake affecting the neuromuscular junction are also risk factors for MC (Prado and Adiao, 2021). MG occurs during the first 2 years after the diagnosis or disease onset; in about 20% of cases, MC became the first manifestation of the disease (Wendell and Levine, 2011) due to respiratory dysfunction, ranging from exercise intolerance to overt respiratory failure, or sleep-disordered breathing (Alcantara et al., 2024) that was experienced by the patients before admission. Others stated that MC appears within the first year after the onset (Schroeter et al., 2018).

In MG, a complete blood count is required monthly during treatment, especially for those receiving glucocorticoids (de Paula Estephan et al., 2022) along with the assessment of latent tuberculosis and updating the vaccine schedule (e.g., influenza and pneumococcal) (Martínez et al., 2025), as the medication may be toxic to renal, hepatic, and other organs. Moreover, the possibility of experiencing MC is high in China, accounting for 40-50%, and the development of other diseases (endocrine disorders, hypertension, obesity, osteoporosis) is high (Li, 2016). The initial medication in the ICU was administering steroids IV to treat mild/moderate to highly active gMG (Wiendl et al., 2023). As respiratory failure was the main focus in MC, intubation and mechanical ventilation were needed after ICU admission (Godoy et al., 2013) along with red-flag assessment and dynamic symptoms. Intubation is needed to secure the airway (Stetefeld and Schroeter, 2019) as experienced in this patient. Further examination showed that pneumonia was the cause of MC, so antibiotic administration was needed (Nadeak and Eka, 2018). Actually, MC required either IVIG or plasmapheresis, depending on which was available at the hospital. However, the patient could not get it because it took time to prepare the procedure and was not available at the time of the patient's arrival. So, the only treatment options available at that time were acetylcholinesterase inhibitors and corticosteroids (Harjana and Hardiono, 2020).

Limitation

This case report has a limitation. Long-term follow-up data were limited; therefore, the patient's subsequent neurological status, risk of recurrent myasthenic crisis, and long-term functional outcome could not be evaluated.

CONCLUSION

Myasthenia crisis (MC) is a common complication of MG that requires positive pressure ventilation as its main treatment. Factors precipitating the crisis should be identified early and promptly managed. Early management and close monitoring may result in better outcomes. Either plasmapheresis or IVIG should be given as early as possible, depending on which one is available in the hospital.

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Conflict of interest

None declared.

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Author contribution

The authors contributed to all processes in this study, including preparation, data gathering and analysis, drafting, and approval for the manuscript's publication.

Patient consent for publication

Written and verbal informed consent to present this case report was obtained from the responsible parties, which in this case, was the patient himself and his/her guardian.

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