A Case Report and Literature Review: Infected Bronchiectasis Induced Myasthenic Crisis Treated Using Noninvasive Ventilator

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Abstract

Introduction: This case report aims to describe an emergency condition of myasthenia gravis in a young adult with a myasthenic crisis due to infected bronchiectasis. The highlight of this case report was the risk factor and the best management of this patient myasthenic crisis episode.
Case Description: A 28-years-old male with early-onset generalized myasthenia gravis came with an emergency condition as a myasthenic crisis in the first month of his therapy. This myasthenic crisis condition was concomitant with infected bronchiectasis, which was predicted as the underlying cause. A myasthenic crisis caused by infected bronchiectasis is a rare case that requires extensive airway support and antibiotics.
Conclusion: Myasthenic crisis concomitant with bronchiectasis is a rare condition. Both of these conditions could lead to mortality. Extensive and aggressive treatment and guidelines are needed to manage this case. Since bronchiectasis is a permanent condition that tends to occur again in the future, proactive management has to be done to prevent infection and recurrent dyspnea.

Keywords: Myasthenia gravis, Myasthenic Crisis, Bronchiectasis, Noninvasive Ventilator, Autoimmune Disease

1. Main text

1.3. Background

Myasthenia gravis (MG) is a rare neuromuscular autoimmune disorder against the voluntary muscle's postsynaptic components. The prevalence of MG in the world was 12,4 people per 100.000 population(Salari et al., 2021). This disease is characterized by weakened striated muscle after continued activity(Jayam Trouth et al., 2012; Salari et al., 2021). The symptoms vary based on the affected striated muscle (Salari et al., 2021). Most MG involves the extrinsic ocular muscle as the initial symptoms, then progress to other bulbar and limb muscles, resulting in a general MG(Jayam Trouth et al., 2012). Early-onset MG is defined when the onset of MG is <50 years old, and late-onset MG is when the onset of MG is >50 years old(Jayam Trouth et al., 2012).

Myasthenic crisis (MC) is a condition of acute neuromuscular respiratory failure that requires mechanical ventilation. Improvements in respiratory care were primarily responsible for reducing mortality in patients with MC(Bedlack and Sanders, 2002; Seneviratne et al., 2008). A crisis is one of the fatal complications of MG(Bedlack and Sanders, 2002). The most often pulmonary comorbidity associated with MC was bronchopneumonia(Sivadasan et al., 2019; Rahul Alfaidin, Kalanjati and Basuki, 2022).

Bronchiectasis is one of the comorbidities of MC that rarely happens (Sivadasan et al., 2019). Traditionally patients with MC are managed using endotracheal intubation and mechanical ventilation(Mazia et al., 2003; Seneviratne et al., 2008). Noninvasive ventilation, such as bilevel-positive airway pressure (BiPAP), seems more desirable to hinder traditional ventilation complications (Seneviratne et al., 2008).

To the best of our knowledge, we report the first case of Myasthenic crisis due to bronchiectasis as the comorbidity in early-onset myasthenia gravis that was under treatment for less than two years. This report highlights the risk factor and the best treatment for this MC patient due to infected bronchiectasis.

1.2. Case report

A 28th years old man came to the emergency room of the general hospital in Gresik City with a chief complaint of dyspnea and fever in the past two days. Dyspnea occurs predominantly during the evening between 4 to 6 pm. He said that it got worse when he coughed. The patient also complained of a productive cough that was hard to secrete sputum, odynophagia, and dysphagia since three days ago. There were no headaches, hemiparesis, lower extremity weakness, and blurred vision. He had been diagnosed with myasthenia gravis in the past month and consumed pyridostigmine 30mg twice daily. The first symptoms were right eyelid weakness followed by mono-paresis of the right upper extremity for two months. The patient had no history of disease other than MG. He did not smoke or consume alcohol.

The patient was stable on the initial physical examination, with no clinical signs of respiratory distress. The vital sign was normal: blood pressure was 120/78mmHg, heart rate 114beat per minute, body temperature 37°C, and respiratory rate 22 times per minute. There was a pulmonary crackle sound in the lower part of both lungs. From the neurological examination, there was ptosis in his right eyelid, the muscle strength was normal in all extremities, and there was a decrease in physiological reflexes of the bilateral biceps, triceps, knee, and Achilles tendon. No pathological reflex was found. The initial blood investigation result (table 1) showed evidence of infection with marked leukocytosis and increasing neutrophil count. There were no abnormalities in hepatic and renal function, and the electrolytes and glucose levels were within the normal range. His Anteroposterior Chest X-ray showed a consolidation over the left perihilar zone and multiple cavities in the lower lobes. This patient underwent a high-resolution computed tomography (HRCT) thorax, and we found an early stage of the right bronchus dilatation in this patient. He was diagnosed with myasthenia gravis with bronchiectasis. This patient also underwent an electromyography test, and there was a decrement of 17,5% of musculus orbicularis oculi in repetitive nerve stimulation (RNS) 3Hz that support the diagnosis of myasthenia gravis in this patient.

He has initially treated with intravenous ceftriaxone 1000mg twice a day, injection of mecobalamin once a day, intravenous metamizole once a day, and pyridostigmine 30mg twice daily. On the second day, his condition worsened, the patient had severe respiratory distress with laboured breathing, and his mental status decreased to agitation and somnolence. The vital sign: blood pressure was 190/168 mmHg, heart rate 100 beats per minute, and respiratory rate 30 times per minute. Arterial blood gas analysis was taken, and the result (table 2) appeared as an acidosis respiratory partially compensated. The initial arterial blood gas showed a decreasing number in the pH level with increased base excess and carbon dioxide retention. There was ongoing respiratory failure type 2 in this patient.

Immediately after the condition worsened, this patient was transmitted to the intensive care unit (ICU) ward and installed BiPAP (bilevel positive airway pressure) ventilation was to support respiration. We chose BiPAP with ventilator setting Fr 15, FiO2 70%, and PEEP 6. After one day of BiPAP, applied blood gas analysis evaluation (table 2) showed improvement in this patient's condition. The respiratory acidosis was

solved, the clinical appearance was improved, and the FiO2 was decreased to 50%. His condition gradually improved, and we withdrew the ventilator on the fifth day and slowly O2 supply from BiPAP to a nonrebreathing mask until he did not need any oxygen support.

We used a combination of two antibiotics to overcome infected bronchiectasis intravenous levofloxacin 500mg and ceftriaxone 1000mg twice a day. On the fourth day, He underwent the second blood test (table 1), and the result was that the level of leucocytes decreased to 13.600mg/dl. We continued to give antibiotics until day ninth. Tuberculosis examination using GeneXpert, and there was no MTB detected. This patient also underwent a blood culture, and the result was that no pathological bacteria were found. Other respiratory treatments we gave were intravenous n-acetylcysteine 600mg twice a day, intravenous aminophylline three ampules in 24 hours, intravenous hydrocortisone 50mg three times a day, Salbutamol nebule every 8 hours, and budesonide nebule every 12 hours. After 12 days of hospital admission, he was discharged with oral pyridostigmine 60mg twice daily and given a salbutamol inhaler to prevent recurrent dyspnea. He is currently followed up every month and responds well to the medication. There was no dyspnea, odynophagia, or dysphagia.

Table 1 Blood investigation at admission

	When Admission	Day four after antibiotics	
Blood Investigation	Result	Result	Normal Range
Hemoglobin	15.1	14.1	13.2-17.3 g%
Platelets	294.000	391.000	150.000-450.000/µL
White Blood Cells	15.100	13.600	3800-10600
Count Blood Cell Types	0/0/0/89/6/5	-	2-4/0-1/3-5/50-70/25-50/2-8
Alkaline phosphatase	32.1	-	0-50 UL
Alanine transaminase	37.6	-	0-50 u/L
Random blood sugar	99	168	<200mg/dL
Creatinine	1.05	-	0.5-1.2mg/dL
Urea	12.2	-	8-18mg/dL
Sodium	132	-	135-147 mmol/L
Potassium	4.5	-	3.5 – 5.0mmol/L
Chloride	103	-	95 – 105 mmol/L

Table 2 BGA blood test results when dyspnea worsens and evaluation

Blood Investigation	Dyspnea Worsen	Evaluation after BiPAP used	Normal Range
Body temperature	36.0°C	37.0°C	
FiO2	0.81	1.00	
pH	7.07	7.41	7.37-7.45
PCO2	78	44	35 – 45
PO2	216	117	71-104
HCO3	22.4	27.3	21 – 25
Base Excess	-8.8	2.3	(-2) - 3
SO2	99	99	94-96

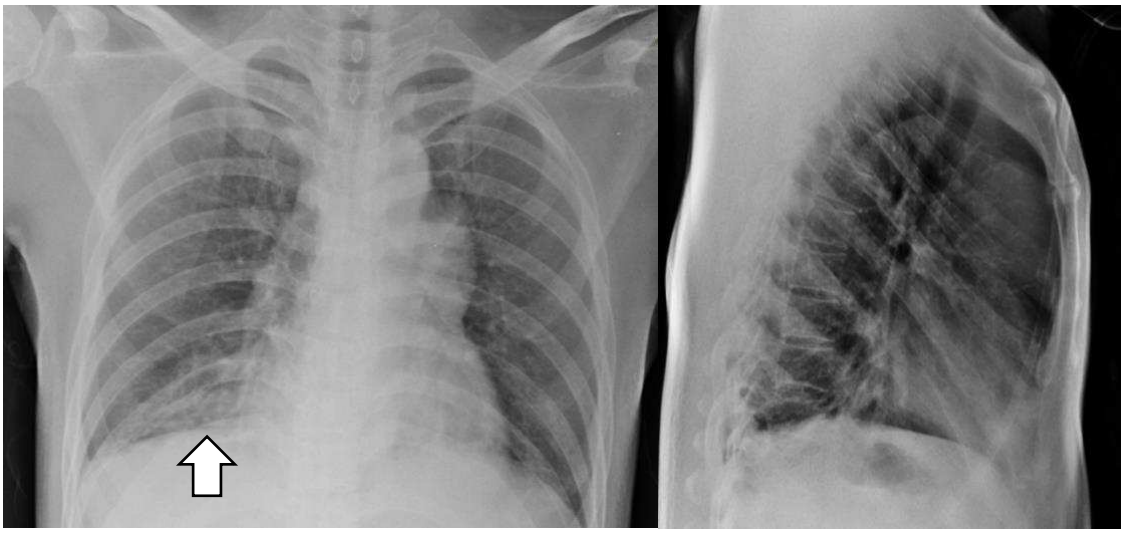
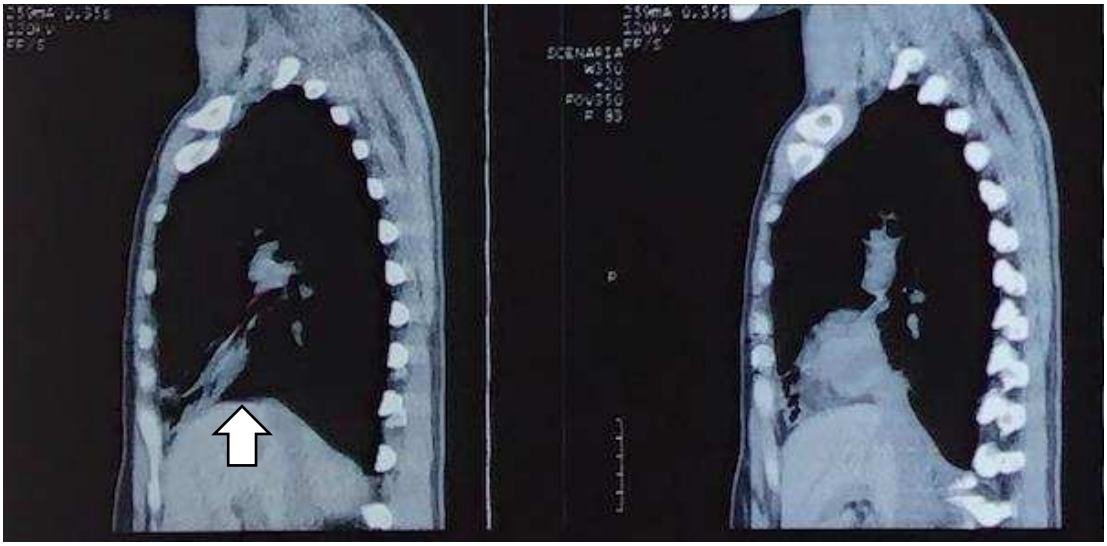


Figure 1. Thorax xray AP/Lateral when first admission showed multiple cavities in the lower lobes (arrow)



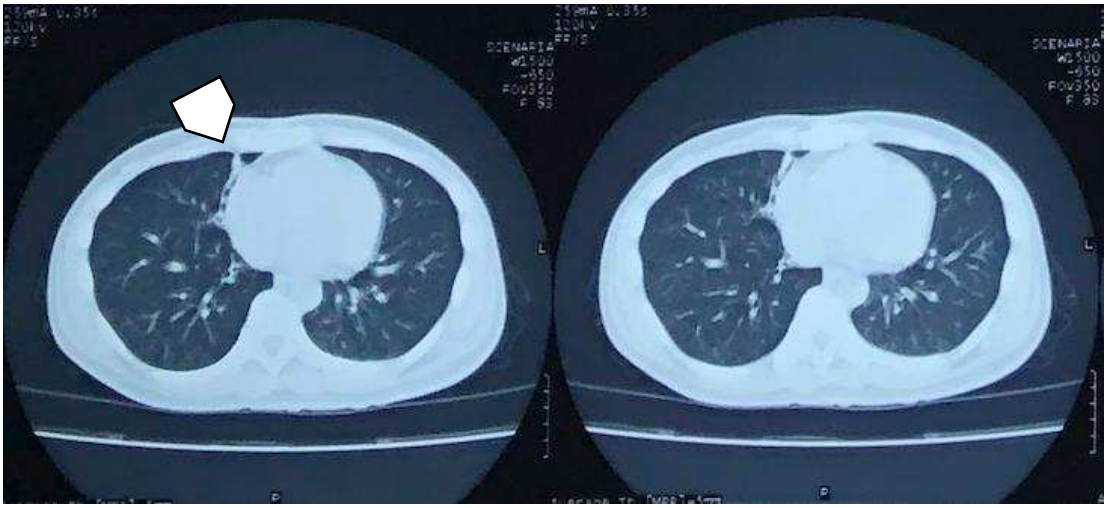
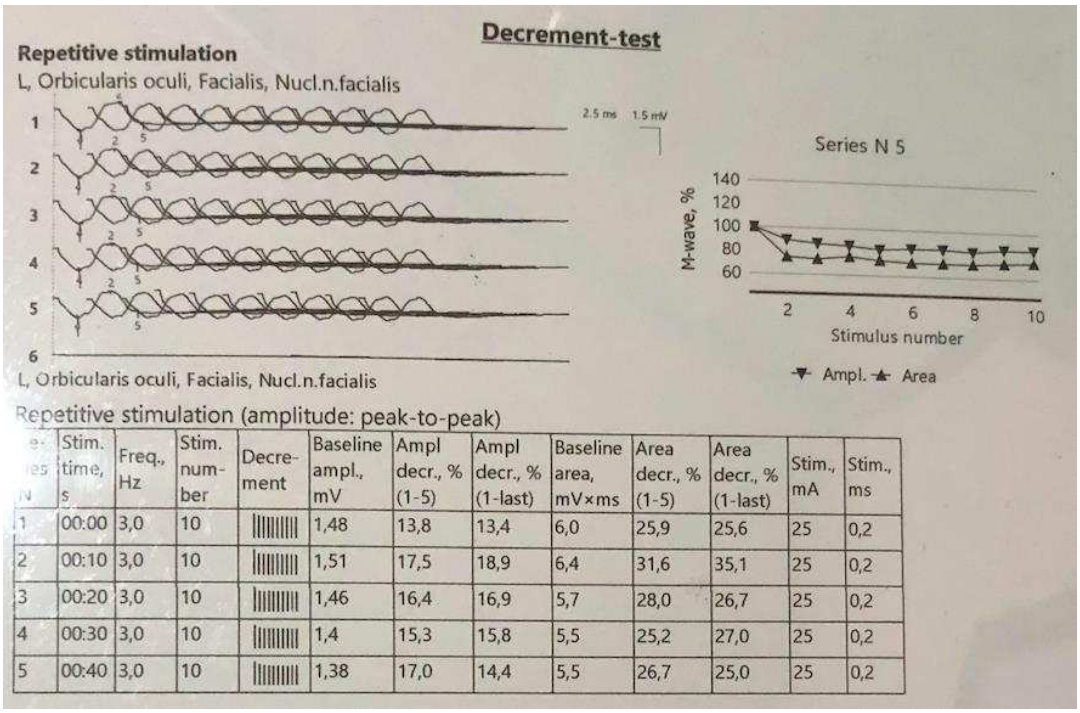


Figure 2. HRCT Thorax showed Early right bronchus dilatation (arrow)



N	Stim. time, s	Freq., Hz	Stim. number	Decrement	Baseline ampl., mV	Ampl decr., % (1-5)	Ampl decr., % (1-last)	Baseline area, mV×ms	Area decr., % (1-5)	Area decr., % (1-last)	Stim., mA	Stim., ms
1	00:00	3,0	10		1,48	13,8	13,4	6,0	25,9	25,6	25	0,2
2	00:10	3,0	10		1,51	17,5	18,9	6,4	31,6	35,1	25	0,2
3	00:20	3,0	10		1,46	16,4	16,9	5,7	28,0	26,7	25	0,2
4	00:30	3,0	10		1,4	15,3	15,8	5,5	25,2	27,0	25	0,2
5	00:40	3,0	10		1,38	17,0	14,4	5,5	26,7	25,0	25	0,2

Figure 3. Electromyography result**:** musculus orbicularis oculi decrement 17,5% after RNS 3Hz

1.3 Discussion

Myasthenia gravis (MG) is an uncommon autoimmune disease characterized by a cardinal sign of fluctuating muscle weakness, worsening with exertion, and improvement with resting in specific skeletal muscles (Kim et al., 2010; Jayam Trouth et al., 2012; Lee et al., 2015). The incidence of myasthenia gravis is

rare only 0.25-2 patients per 100.000(Wendell and Levine, 2011). Weakness also worsens with infection, heat, and stress(Jayam Trouth et al., 2012). MG is caused by an autoantibody attack on the acetylcholine receptors at the motor end plate of striated muscle(Kim et al., 2010). Severe muscle weakness involving the bulbar muscle can cause dysphagia and a depressed cough. Weakness associated with respiratory muscle is rarely present in the first two years of onset in about 3 - 8% of all cases(Kim et al., 2010; Jayam Trouth et al., 2012). This type of weakness can lead to a life-threatening phenomenon called a myasthenic crisis (Jayam Trouth et al., 2012). Until now, the natural history of myasthenia gravis is unpredictable(Sivadasan et al., 2019).

Myasthenia gravis, associated with acute respiratory failure, was a myasthenic crisis. 15 – 20% of myasthenic Gravis patients are affected by a myasthenic crisis at least once in a lifetime (Wendell and Levine, 2011; Sivadasan et al., 2019). The myasthenic crisis results from weakness of the upper respiratory muscle leading to obstruction, weakness, and reduced tidal volume(Kozak et al., 2016; Sivadasan et al., 2019). It has been reported that myasthenic crises most often happen in generalized MG classification. The common precipitating factor for myasthenic crisis includes respiratory infection, aspiration, sepsis, surgical procedure, rapid tapering of immune modulation agents, starting corticosteroid treatment, and exposure to antibiotics, cardiac drugs, and magnesium(Kozak et al., 2016). 50% of the precipitating factor for the crisis was an infection. Bronchopneumonia was diagnosed in 32.2%, and bronchiectasis is one of the MC comorbidities that is rarely mentioned(Wendell and Levine, 2011; Sivadasan et al., 2019). Respiratory infection, mucous encumbrance, and progressive respiratory muscle weakness might lead to respiratory failure in neuromuscular disorder patients (Racca et al., 2020).

In the present case, infected bronchiectasis was believed to be the underlying problem that caused the MC episode in our patient. Bronchiectasis is an abnormal permanent dilatation of the bronchi and airway obstruction. 50% of bronchiectasis is termed patho-inflammatory because there has an association with dysfunctional host immunity toward pathogens (Boyton and Altmann, 2016; Jeong et al., 2016). This condition leads to lung remodelling and lung damage associated with recurrent infection. Bronchiectasis may present in autoimmune diseases as well as the condition of immune dysregulation(Boyton and Altmann, 2016). Long-term bronchodilator therapy is associated with improved lung function, dyspnea, and health status in chronic pulmonary disease patients, including bronchiectasis(Jeong et al., 2016). Therefore, we gave a long-term bronchodilator to this patient.

There was a rapid worsening of respiratory failure less than 24 hours after admission and three days after the first symptoms appeared. Acute respiratory failure may develop rapidly progressive in myasthenia gravis. Respiratory failure is when the respiratory system fails to do one or both gas exchanges; oxygenation and carbon dioxide elimination. MG patient often causes hypercapnia respiratory failure because the ventilatory function fails, resulting in CO_2 retention hypercapnia(Racca et al., 2020). Myasthenic crisis can involve both upper airway muscles and respiratory muscles that cause dyspnea. Upper airway weakness can lead to respiratory obstruction by the tongue and increase the work of breathing against a closed airway. Bulbar weakness like dysphagia, nasal regurgitation, nasal quality of speech, staccato speech, jaw and tongue weakness were other signs of a weak upper airway(Wendell and Levine, 2011). The combination of upper airway obstruction and hypoventilation may result in respiratory failure(Racca et al., 2020).

Respiratory muscle weakness caused by neuromuscular diseases such as myasthenia gravis has long been recognized to cause respiratory failure with carbon dioxide retention or hypercapnic respiratory failure(Rochester, 1992; Racca et al., 2020). A commonly complicated disease with hypercapnic respiratory failure would also have acidosis. In the early stage of hemidiaphragm paralysis, postural-related dyspnea and acute respiratory acidosis during the preceding night can happen (Rochester and Arora, 1983). This process explains why in our case, there was worsening dyspnea in the evening.

Involving intensive care patients with myasthenic crises will decrease the mortality rate from 42% in the 1960s to 4% (Sivadasan et al., 2019). Patients with MC with a high level of PCO2 >50 mmHg and a high serum bicarbonate concentration at admission are the predictive factors for NIV failure(Racca et al., 2020).

Patients in crisis requiring endotracheal intubation spend a median of 17 days in the hospital(Wendell and Levine, 2011). Most MG patients associated with acute respiratory failure are assisted with conventional modes of mechanical ventilation that could lead to many complications(Mazia et al., 2003). Noninvasive ventilation may prevent intubation or reintubation in a patient with a myasthenic crisis and have fewer complications after ventilation weaning(Wendell and Levine, 2011). BiPAP would give positive pressure during inspiration and expiration to enhance airflow, alleviate work of breathing, and prevent airway collapse and atelectasis during expiration. Using NIV is associated with a shorter duration of ventilatory support ranging between 4 to 9 days, prevent the use of invasive ventilation, associated complication with invasive ventilation, and reduce complication associated with the duration length of stay in the hospital(Agarwal, Reddy and Gupta, 2006; Wendell and Levine, 2011). We chose to use noninvasive mechanical ventilation, and the result was good, and no complication was detected. The duration of our cases using the BiPAP ventilator was only five days, and on the second day of using BiPAP, the FiO2 already decreased to 50% from 70%.

1.4 Conclusion

Myasthenic crisis can happen in any phase of myasthenia gravis. One of the precipitating factors is an infection, including infected bronchiectasis. Bronchiectasis is a morphological defect in the bronchus that tends to be recurrent. Long-term bronchodilators could improve lung function and dyspnea. While treating a myasthenic crisis, aggressive treatment such as mechanical ventilation and antibiotics is needed. Noninvasive mechanical ventilation can be a choice to hinder the complication of an invasive ventilator.

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