CASE REPORT : A NON MUSCLE RELAXANT TECHNIQUE FOR A MYASTHENIA GRAVIS PATIENT UNDERGOING VIDEO-ASSISTED THORACOSCOPIC SURGERY

Marilaeta Cindryani Ra Ratumasa[1], Kadek Agus Heryana Putra[2], Putu Bagus Arisadika[3*]
Anesthesiology and Intensive Care Department, Prof. Dr. I.G.N.G. Ngoerah *General, Hospital*/Udayana *University*, Denpasar, Bali, Indonesia[1,2,3]
[*]*Corresponding Author :* putu.bagus001@student.unud.ac.id

ABSTRAK

Miastenia gravis (MG) adalah kelainan autoimun kronis langka yang mengganggu transmisi neuromuskular dan ditandai dengan kelemahan otot rangka yang berfluktuasi. Penatalaksanaan anestesi pada pasien dengan MG menghadirkan tantangan yang signifikan, terutama karena sensitivitas mereka yang berubah terhadap agen anestesi dan peningkatan risiko komplikasi pernapasan pascaoperasi. Seorang pria berusia 54 tahun yang didiagnosis dengan MG dijadwalkan menjalani operasi torakoskopi berbantuan video (VATS) untuk membuat jendela perikardial dan mendapatkan biopsi, yang dipicu oleh adanya efusi perikardial melingkar sedang hingga berat. Riwayat medisnya meliputi kesulitan pernapasan dan penyakit paru restriktif, yang memerlukan pendekatan anestesi yang cermat yang menghindari penggunaan agen penghambat neuromuskular untuk mencegah risiko kelumpuhan yang berkepanjangan. Anestesi dipertahankan dengan aman menggunakan kombinasi remifentanil dan propofol, dan isolasi paru-paru dicapai secara efektif dengan pemasangan tabung endotrakeal lumen ganda. Pendekatan ini memungkinkan upaya pernapasan spontan dan kondisi intraoperatif yang stabil. Kasus ini menggambarkan pentingnya perencanaan anestesi individual pada pasien MG, dengan menekankan perlunya menghindari relaksan otot dan mempertahankan fungsi pernapasan, terutama dalam prosedur bedah toraks. Dengan menyesuaikan strategi anestesi dengan pertimbangan patofisiologi spesifik MG, hasil perioperatif yang optimal dapat dicapai pada populasi berisiko tinggi ini.

Kata kunci : blokade neuromuscular, manajemen anestesi, myasthenia gravis, operasi toraks

ABSTRACT

Myasthenia gravis (MG) is a rare chronic autoimmune disorder that impairs neuromuscular transmission and is characterized by fluctuating skeletal muscle weakness. The anesthetic management of patients with MG presents significant challenges, particularly due to their altered sensitivity to anesthetic agents and increased risk of postoperative respiratory complications. A 54-year-old male diagnosed with MG was scheduled for video-assisted thoracoscopic surgery (VATS) to create a pericardial window and obtain a biopsy, prompted by the presence of a moderate-to-severe circumferential pericardial effusion. His medical history included respiratory difficulties and restrictive lung disease, necessitating a careful anesthetic approach that avoided the use of neuromuscular blocking agents to prevent the risk of prolonged paralysis. Anesthesia was safely maintained using a combination of remifentanil and propofol, and lung isolation was effectively achieved with the placement of a double-lumen endotracheal tube. This approach allowed for spontaneous respiratory effort and stable intraoperative conditions. The case illustrates the critical importance of individualized anesthetic planning in patients with MG, emphasizing the need to avoid muscle relaxants and preserve respiratory function, especially in thoracic surgical procedures. By tailoring the anesthetic strategy to the specific pathophysiological considerations of MG, optimal perioperative outcomes can be achieved in this high-risk population.

Keywords *: myasthenia gravis, thoracic surgery, anesthesia management, neuromuscular blockade*

INTRODUCTION

The anesthetic management of patients myasthenia gravis (MG) remains problematic due to the risk of precipitating myasthenic crisis postoperatively with prolonged need for mechanical ventilation. Patients with MG are often hypersensitive to the use of neuromuscular blocking agents that are administered to facilitate the delivery of general, endotracheal anesthesia, and their effects can be unpredictable. The risk of developing myasthenic crisis after surgery with muscle relaxants has been reported to be in the range of approximately 5% to 20% (Dewilde, et al., 2023). Anesthetic management in patients with MG presents unique challenges due to their increased sensitivity to neuromuscular blocking agents, impaired respiratory function, and potential for exacerbation of symptoms (Daum, et al., 2021). The use of muscle relaxants in these patients must be carefully considered, as prolonged weakness postoperatively could necessitate mechanical ventilation and delay recovery (Urovi, 2023).

This report details the anesthetic management of a 54-year-old male with MG undergoing VATS for a pericardial window and biopsy. The perioperative plan included avoidance of muscle relaxants to minimize the risk of prolonged neuromuscular blockade and respiratory complications. This case highlights the importance of tailoring anesthetic strategies for patients with MG, with a focus on maintaining spontaneous respiratory function and ensuring patient safety during complex thoracic procedures. Myasthenia gravis alters the function of the neuromuscular junction by producing autoantibodies that target acetylcholine receptors, thereby impairing synaptic transmission and resulting in fluctuating skeletal muscle weakness. These pathophysiological changes not only increase patients' susceptibility to certain anesthetic agents but also lead to heightened sensitivity to non-depolarizing neuromuscular blocking drugs. Studies have shown that even small doses of neuromuscular blockers can result in prolonged paralysis or delayed emergence from anesthesia (Sanders et al., 2016).

Therefore, the decision to avoid muscle relaxants in the presented case aligns with current best practices aimed at reducing postoperative morbidity and the risk of myasthenic crisis. In addition to neuromuscular concerns, MG patients are frequently burdened by underlying respiratory dysfunction due to intercostal and diaphragmatic muscle involvement. As thoracoscopic procedures often necessitate one-lung ventilation and controlled airway manipulation, anesthetic regimens that preserve spontaneous respiration and allow for rapid recovery of ventilatory function are preferred. The use of short-acting agents like remifentanil and propofol, as demonstrated in this case, supports a smoother emergence and minimizes respiratory depression, especially when neuromuscular blockade is not employed (Sloan & Wahidi, 2021).

Furthermore, perioperative planning in MG patients should involve multidisciplinary coordination, including neurologists and anesthesiologists, to optimize preoperative function and anticipate intraoperative risks. Preoperative assessment should review recent disease activity, current medication use (e.g., pyridostigmine, corticosteroids), and pulmonary function tests. Evidence suggests that patients with well-controlled disease, minimal bulbar involvement, and adequate respiratory reserve have better postoperative outcomes, particularly when anesthetic strategies are individualized (Ahmed et al., 2018). Thus, the comprehensive and tailored approach applied in this case reflects an evidence-based strategy for reducing complications in MG patients undergoing major surgery.

CASE REPORT

A 54-year-old male presented with complaints of intermittent shortness of breath that worsened progressively over three months. The breathlessness became more pronounced during long walks and required the patient to use an elevated pillow while sleeping. There was

no history of paroxysmal nocturnal dyspnea. The patient denied any persistent cough, hemoptysis, chest pain, fever, night sweats, or significant weight loss. He had a medical history of myasthenia gravis diagnosed 12 years ago, managed with Mestinon (pyridostigmine) 60 mg three times daily, and a previous NSTEMI in February 2022, for which he underwent coronary stenting. He was also treated successfully for pulmonary tuberculosis in 2010. The patient was a former active smoker who smoked cigarettes daily. Despite his recent symptoms, he maintained his activities as a lecturer without notable limitations from shortness of breath or chest pain.

Table 1. Physical Examination and Preoperative Assessment

Patient Physical Examination			
TD	130/70 mmhg	Spo2	96/% NK 4 L/min
HR	98 per min	RR	18 Breath per min
BB	67 kg	BMI	25.8 kg/m².
Respiration	Respiratory frequency 18 time per minute, vesicular in both, lung fields, no rhonchi and/or wheezing, SpO2 96% NK 4 L/min	Urogenital	Spontan urination
Cardiovascular	Pulse rate 98 beats per minute, strong pulse, heart sounds 1 and 2 single, regular, no gallop and murmur was observed	Musculoskeletal	Warm extremities, CRT < 2 seconds, good flexion
Gastrointestinal	Supple, bowel sounds (+), no distension, tenderness		

On examination, he was fully alert and oriented. Neurological examination revealed mild generalized muscle weakness, particularly involving the oropharyngeal muscles, along with dysarthria and dysphonia. There was no ptosis, diplopia, dysphagia, or facial muscle weakness which further aligned with Class II categorization of MGFA. Airway assessment showed a Mallampati score of III, indicating moderate difficulty for intubation. The patient had a complete set of teeth, no loose teeth, and good neck mobility. His LEMON score indicated moderate difficulty, primarily due to Mallampati III and evidence of oropharyngeal weakness. The patient's ASA physical status was III, given his comorbid conditions, including myasthenia gravis and ischemic heart disease. The MOANS score for this patient revealed 1 out of 5. The mask seal is deemed adequate (Mask Seal), without any findings of obstruction (Obstruction). The patient is under 55 years old (Aged > 55 yr), has no missing teeth (No Teeth), and has no stiff lungs (Stiff Lung).

Supporting Investigations

Laboratory findings showed leukocytosis with a WBC count of 20.27 × 10^3/µL, mild anemia with hemoglobin at 11.2 g/dL, and normal platelet count. Liver and renal function tests were within normal limits, although mild elevations in creatinine (1.42 mg/dL) and blood urea nitrogen (14.2 mg/dL) were noted. Electrolyte levels, including sodium, potassium, and chloride, were within normal ranges. Spirometry demonstrated severe restrictive lung disease with FVC at 770 mL (25.25% of predicted) and FEV1 at 650 mL (27.97% of predicted), with an FEV1/FVC ratio of 84.42%. Imaging studies included a chest X-ray, which revealed cardiomegaly, bilateral minimal pleural effusion, and consolidation in the lungs, consistent with pneumonia. An echocardiogram showed moderate-to-severe circumferential pericardial effusion, with the largest dimension being 1.9 cm at the inferolateral left ventricle and 1.1 cm at the right ventricular apex. Tamponade signs, such as right atrial and right ventricular collapse,

were present. A successful pericardiocentesis had been performed two weeks prior, yielding 150 mL of serous fluid. Follow-up imaging showed a minimal residual pericardial effusion. The patient was scheduled for video-assisted thoracoscopic surgery (VATS) for a pericardial window and biopsy.

Anesthesia Management

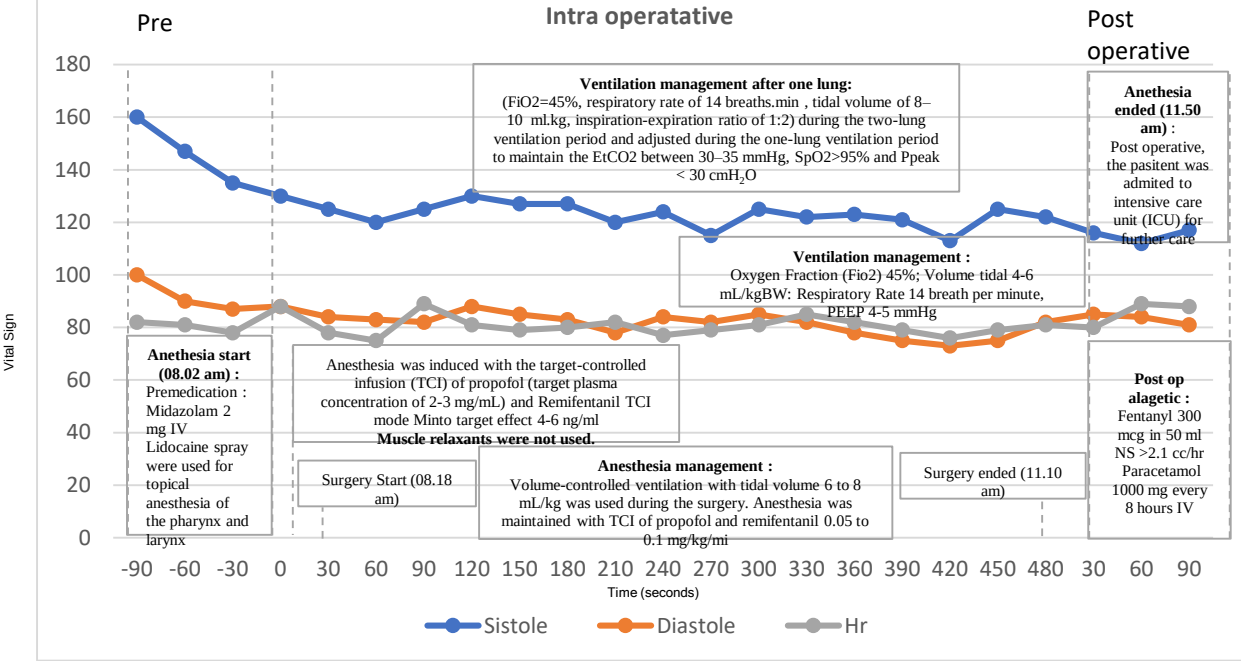

Figure 1. Patient Hemodinamic Durante Operation

The patient was prepared thoroughly before surgery, given his comorbidities and restrictive lung condition. Preoperative preparation included respiratory muscle training, nebulization therapy with inhavent 1 respule, and optimizing the management of myasthenia gravis with Mestinon. Informed consent was obtained for anesthesia and the procedure. An arterial line was placed in the left radial artery after a negative Allen test, providing continuous hemodynamic monitoring. Premedication included midazolam 2 mg IV to reduce anxiety. Induction was performed with remifentanil via target-controlled infusion (TCI) and propofol titrated to achieve hypnosis. No muscle relaxants were administered to avoid exacerbating the patient's myasthenia gravis and to maintain spontaneous respiratory effort. Intubation was achieved with a left-sided double-lumen endotracheal tube (DLT), with proper placement confirmed by auscultation and bronchoscopic visualization. The patient was positioned in a left lateral decubitus position for the thoracoscopic procedure.

Anesthesia was maintained with a combination of oxygen, compressed air, and propofol infusion at 50–150 mcg/kg/min. Analgesia was achieved with fentanyl infusion and IV paracetamol. The use of a DLT enabled effective lung isolation, which was critical for the surgical approach. Hemodynamic stability was maintained throughout the procedure, which lasted approximately three hours. Intraoperative blood loss was minimal and did not require transfusion.

RESULT AND DISCUSSION

Myasthenia gravis (MG) is an autoimmune disease characterized by the production of autoantibodies targeting acetylcholine receptors (AChRs) at the postsynaptic neuromuscular

junction. This results in reduced signal transmission and fluctuating muscle weakness, which is exacerbated by factors such as stress, fatigue, infections, and certain drugs (Dewilde, et al., 2023). In particular, MG patients are extremely sensitive to non-depolarizing muscle relaxants, which can cause prolonged paralysis due to their impaired ability to recover neuromuscular function. Depolarizing agents like succinylcholine also possess great threat, as MG patients may require higher doses due to a reduced number of functional AChRs, yet still face unpredictable responses and risks of hyperkalemia (Sheikh, et al., 2021) (Tosh, et al., 2020).

Thoracic surgeries such as VATS further complicate the anesthetic management of MG patients. Procedures requiring lung isolation and prolonged anesthesia can strain already weakened respiratory muscles, increasing the risk of postoperative respiratory failure (Urovi, 2023) (Yun, et al., 2022). Additionally, the potential for myasthenic or cholinergic crises must be addressed through careful monitoring of anticholinesterase therapy and avoidance of triggers that exacerbate neuromuscular weakness (Collins, et al., 2020) (Senapathi, et al., 2020). In this case, preoperative optimization was critical given the patient's comorbidities and restrictive lung disease. The patient presented with moderate-to-severe pericardial effusion and a history of myasthenia gravis classified as MGFA class II, predominantly affecting oropharyngeal muscles. His spirometry results indicated severe restrictive lung disease, which significantly increased the risk of perioperative complications. Preoperative preparation included respiratory muscle training and nebulization therapy to improve pulmonary function. The patient's myasthenia was managed with regular doses of pyridostigmine (Mestinon), which was continued up to the morning of surgery to maintain baseline neuromuscular function. Della Rocca G et al. investigated the perioperative conditions of general anesthesia without muscle relaxants, using either propofol or sevofurane, for VATS in MG patients (Della, et al., 2003).

Although propofol was administered as a continuous infusion without monitoring the depth of anesthesia, they found that both techniques provided good intraoperative conditions and allowed for early extubation in the operating room after a trans-sternal procedure. In the present study, similar anesthetic agents were utilized in patients with comparable characteristics. However, these patients underwent laparoscopic thoracic surgery, which necessitated onelung ventilation during the surgical procedure and an aggressive intraoperative movement may interrupt the procedure or even cause severe surgical complications. A key decision in this case was to avoid muscle relaxants entirely, thereby reducing the risk of prolonged neuromuscular blockade and postoperative ventilatory support. Instead, a combination of remifentanil and propofol was used for induction and maintenance of anesthesia. Remifentanil, an ultra-short-acting opioid, provided excellent analgesia and allowed precise titration to maintain spontaneous breathing. Propofol ensured adequate hypnosis while preserving neuromuscular function. The use of a double-lumen endotracheal tube (DLT) for lung isolation was successfully achieved without neuromuscular blockade, demonstrating that intubation can be safely performed in MG patients with appropriate sedation and topical anesthesia (Vanjari & Maybauer, 2020) (Wu, et al., 2023).

Rowbottom in 1989 showed that isoflurane provides good operating conditions without the need for muscle relaxants, allowing rapid recovery from anaesthesia and minimal postoperative weakness or respiratory depression (Rowbottom, 1989) Lung isolation was necessary for the thoracoscopic procedure, and the patient was positioned in a left lateral decubitus position to facilitate surgical access. Maintaining oxygenation and ventilation was critical, particularly given the patient's restrictive lung disease. The anesthetic regimen included oxygen, compressed air, and continuous propofol infusion, with close monitoring of arterial blood gases and end-tidal CO_2 to ensure adequate respiratory function (Urovi, 2023) (Yun, et al., 2022) (Dezube, et al., 2021) Chevalley C et al. found that postoperative artifcial ventilation incidence is four times higher in patients with MG than in those without MG when

giving balanced anesthesia, and that fgure was fourteen times when using muscle relaxants. The advantages of early recovery might increase the treatment efectiveness of MG and reduce the length of hospital stay (Chevalley, et al., 2001).

Hemodynamic stability was maintained throughout the three-hour procedure, with no significant fluctuations in blood pressure or heart rate. Blood loss was minimal, and no transfusion was required. The avoidance of neuromuscular blocking agents minimized the risk of residual paralysis, while judicious use of opioids and paracetamol provided effective analgesia (Sheikh, et al., 2021) (Karattuparambil, et al., 2021). Postoperative respiratory failure is a common concern in MG patients, especially after thoracic surgery. In this case, the patient's readiness for extubation was carefully assessed using a cuff leak test and a spontaneous breathing trial. The absence of stridor or signs of airway compromise ensured that extubation could be safely performed. Post-extubation, the patient was closely monitored in the intensive care unit (ICU) to detect any early signs of respiratory deterioration or myasthenic crisis. Pain management was a priority to facilitate early mobilization and respiratory physiotherapy. A combination of fentanyl infusion and scheduled paracetamol provided effective analgesia without suppressing respiratory drive. Respiratory therapy, including incentive spirometry and deep breathing exercises, was initiated early to prevent atelectasis and promote recovery (Karunarathna, et al., 2024).

CONCLUSION

In conclusion, this case exemplifies the complexities involved in managing myasthenia gravis (MG) to avoiding muscle relaxants and using a combination of remifentanil and propofol can preserve spontaneous respiratory function and support a smoother recovery. It highlights the importance of tailored anesthetic planning and alternative techniques in achieving favorable outcomes for high-risk patients with MG.

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