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Intraoperative cardiogenic shock induced by refractory coronary artery spasm in a patient with myasthenia gravis: A case report

refractory coronary artery spasm

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Abstract

BACKGROUND

Coronary artery spasm (CAS) is a rare but critical condition during surgery. Clinical manifestations can vary from only subtle change in electrocardiography to sudden death. In this case report, we present a case of a patient with myasthenia gravis who developed refractory CAS-related cardiogenic shock during thymoma surgery.

CASE SUMMARY

A 61-year-old male had a history of cigarette smoking and coronary artery disease after a bare metal stent. Three months ago, He had suffered from coronary spasms occurred with three vessels involved after surgery for cervical spine injury. He started having progressive dysphagia 4 wk prior and was diagnosed myasthenia gravis (MG) *via* serologic tests and computed tomography also declared a thymoma over anterior mediastinum. After the symptoms of myasthenia gravis subsided, He was referred for thymectomy. The operation was uneventful until the closing of the sternal wound. Electrocardiography showed sudden onset ST elevation, followed by ventricular tachycardia and severe hypotension. Cardiopulmonary cerebral resuscitation was initiated immediately with electrical defibrillation, Extracorporeal membrane

oxygenation (ECMO) was cannulated due to refractory cardiogenic shock, he was transferred to an angiography room. Angiography showed diffuse coronary artery spasm with three vessels involved, intracoronary isosorbide dinitrate and adenosine were administered then the patient was transferred to the intensive care unit.

CONCLUSION

Our case highlights the importance of being prepared for clinical situations such as the one described here and suggests the necessity of developing an appropriate anesthesia plan that includes proactive analgesia and preemptive coronary vasodilators.

Key Words: Coronary spasm; Myasthenia Gravis; Thymectomy; Shock

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Core Tip: In previous literature reviews, it has been noted that a correlation exists between myasthenia gravis and cardiac complications, such as coronary artery spasms, which frequently manifest as chest pain in affected patients. Nevertheless, when myasthenia gravis coincides with thymoma, surgical intervention is often necessary. The diagnosis of coronary artery spasms while the patient is under general anesthesia poses a considerable challenge. Our case report aims to underscore scenarios of this nature and suggests an optimal anesthesia strategy in such cases.

INTRODUCTION

Coronary artery spasm (CAS) was recently recognized as a cause of myocardial infarction with nonobstructive coronary arteries[1]. The transient cessation of the coronary blood supply causes clinical manifestations that mimic ischemic heart disease. Perioperative CAS can be challenging for anesthesiologists, especially when patients are

sedated or under general anesthesia. We present a case of myasthenia gravis (MG) that developed intraoperative coronary spasm-related cardiogenic shock during thymoma surgery.

CASE PRESENTATION

Chief complaints

A 61-year-old male was diagnosed myasthenia gravis and thymoma. He was scheduled for median sternotomy to undergo resection of a mediastinum tumor.

History of present illness

He started having progressive dysphagia 4 wk prior, and the associated symptoms included diplopia, ptosis, general weakness, and easy choking. He denied chest pain, bloody sputum, fever. Serologic tests were positive for antibodies against the acetylcholine receptor (serum level: 88.3 nmol/L). Computed tomography revealed a 5.4 cm enhanced lobular mass in the anterior mediastinum, which was declared to be a thymoma. He was diagnosed with myasthenia gravis, and intravenous immunoglobulin was administered at a dose of 600 mg/kg QD for 5 consecutive days. The symptoms of myasthenia gravis subsided after 20 days, and he was referred for surgical intervention. Preoperative echocardiography revealed preserved systolic function and normal wall motion without major valvular dysfunction. Thus, a medium sternotomy anterior mediastinum tumor resection was arranged.

In the operating theater, general anesthesia was induced with lidocaine 60 mg, thiamylal sodium 300 mg, fentanyl 50 mcg and rocuronium 40 mg. A 37-fr double lumen endotracheal tube was intubated, and then an arterial line and a central venous catheter were placed smoothly. The operation was uneventful until the closing of the sternal wound. Electrocardiography showed sudden onset ST elevation, followed by ventricular tachycardia and severe hypotension. Cardiopulmonary cerebral resuscitation was initiated immediately with electrical defibrillation 200 J, and the surgeon started to perform direct cardiac massage. However, ventricular

tachycardia/fibrillation and hypotension persisted. Extracorporeal membrane oxygenation (ECMO) was cannulated 40 minutes after the initiation of cardiopulmonary cerebral resuscitation.

History of past illness

He had a history of cigarette smoking and coronary artery disease after a bare metal stent 11 years prior. In 2021/01, he suffered from a cervical spine injury with disc fracture at C5–6 and central cord syndrome from a traffic accident. He underwent cervical discectomy and interbody fusion with a cervical cage. After transfer to the intensive care unit, chest pain was mentioned. Then, sudden onset bradycardia following ventricular tachycardia and cardiac arrest occurred. Coronary angiography showed spasms in three vessels without obvious atherosclerotic lesions. He was transferred to a normal ward 10 days later and then discharged after rehabilitation was completed.

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Personal and family history

The patient denied any family history of myasthenia gravis.

Physical examination

After ECMO insertion, and arterial blood pressure was approximately 90/50 mmHg. The heart rate was around 70 beats per minute and respiratory rate was set at 12 breaths per min. capnography showed low end tidal CO_2 level (under 20 mmHg).

Laboratory examinations

Arterial blood gas data showed acidosis (PH 7.304) with elevated $PaCO_2$ (70.4 mmHg) and $HCO3^-$ (35.3 mEq/L). Serum lactate level also increased (8.5 mmol/L). serum CK and CKMB level was in normal range but Troponin-T level elevated (0.039 ng/mL).

Imaging examinations

Electrocardiography returned to sinus rhythm with ST elevation 10 minutes. Transesophageal echocardiography was placed later and revealed global hypokinesia. Angiography showed diffuse coronary artery spasm with three vessels involved (Figure 1).

FINAL DIAGNOSIS

Cardiogenic shock due to diffuse coronary artery spasm with three vessels involved.

TREATMENT

A total of 1600 mg intracoronary isosorbide dinitrate and 360 mg adenosine were administered. After transient relief, refractory spasm was noted at RCA-m (Figure 2); thus, a bare metal stent was placed (Figure 3). An intra-arterial balloon pump was placed due to poor contraction of the left ventricle, and then the patient was transferred to the intensive care unit.

OUTCOME AND FOLLOW-UP

The patient regained consciousness on the following day. A week later, echocardiography revealed improved left ventricular systolic function; thus, the intra-arterial balloon pump and ECMO were removed. He was then transferred to a ward for a rehabilitation program and discharged. However, he had pneumonia and progressed into sepsis 5 mo later and expired due to multiorgan failure.

DISCUSSION

CAS is a rare condition, and its diverse manifestations can sometimes be critical, especially perioperatively. Some risk factors of CAS have been identified, such as age, sex, smoking, and physical and mental stress, and the usage of sympathomimetic and parasympathomimetic agents can be precipitating factors. The pathophysiology of CAS can be multifactorial, including endothelial dysfunction, autonomic nervous system disorder and oxidative stress. One study reviewed 115 cases with perioperative CAS,

and most cases CAS occurred during abdominal or thoracic surgery. The author considered inadequate depth of general anesthesia, use of vasopressors, and vagus nerve stimulation as possible contributing factors. Most patients had normal preoperative electrocardiograms. However, almost every patient (97%) presented ST segment changes when CAS occurred, and approximately 20% were associated with ventricular fibrillation or cardiac arrest[2].

MG is a neuromuscular autoimmune disease, and antibodies to acetylcholine receptors at neuromuscular junctions cause muscle weakness. Usually, antibodies bind only bind to skeletal system. However, in patients with MG combined with thymoma, specific striational antibodies bind to heart muscle, which may be related to the myocarditis and myositis that occurs in MG patients[3]. Several case reports have presented the occurrence of CAS in patients with MG after cholinesterase inhibitor or intravenous immunoglobulin treatment[4]. Acetylcholine, as a parasympathetic neurotransmitter of the endothelium, is usually related to coronary dilation; however, it can induce vasospasm through vascular smooth muscle constriction when the endothelium is damaged[5,6]. While the precise mechanism is not fully understood, MG and its treatments can influence myocardium and coronary function through different pathways, causing patients to be at risk of cardiovascular events.

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To the best of our knowledge, this is the first reported case of intraoperative coronary spasm in a patient with MG who underwent thymectomy. Our case had several risk factors for CAS, including cigarette smoking and atherosclerotic coronary artery disease. He also suffered from coronary spasm after traumatic cervical spine injury. He was diagnosed with MG and administered anticholinergic and intravenous immunoglobulin treatments. Thus, we cannot simply attribute the cause to a single factor. In our case, high-quality cardiopulmonary cerebral resuscitation and successful ECMO cannulation were crucial, and he recovered without complications. A previous study announced that prophylactic coronary vasodilators may bring benefits that reduce the risk of CAS[7]. To avoid noxious stimuli, an adequate anesthesia depth is necessary. The epidural catheter technique is widely used in thymectomy as an effective

analgesia. However, it can also induce coronary spasm, so the risks and benefits need to be determined[2,8]. We suggest that sugammadex should be used for the reversal of neuromuscular function if postoperative extubation is indicated. In summary, the potential risk of cardiovascular events should be taken into consideration for patients with MG undergoing surgery.

CONCLUSION

In past literature reviews, an association between MG and CAS, has been reported. Patients with these conditions often present with chest pain. However, when MG is combined with thymoma, surgical intervention is frequently required. Diagnosing CAS under general anesthesia can be very challenging. Our case report presented a particularly devastating CAS that necessitated the use of ECMO and an intra-aortic balloon pump (IABP). We identified severe heart failure using transesophageal echocardiography and promptly closed the surgical incision to transfer the patient to the catheterization room for further treatment. Reflecting on this case, we propose an appropriate anesthesia plan, including proactive pain management, prophylactic coronary vasodilators, and always keeping the possibility of such complications as a differential diagnosis. Further research is needed to explore this complex relationship in the future.

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