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Coronary Artery Bypass Grafting in a Patient with Myasthenia Gravis

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ABSTRACT

A 70-year-old male patient with myasthenia gravis required coronary artery bypass grafting due to triple-vessel disease. The anesthetic management was performed with general anesthesia using reduced doses of muscle relaxants. He was extubated four hours after surgery and the postoperative course was uneventful. Coronary artery bypass surgery in myasthenic patients can be challenging to anesthesiologists and cardiac surgeons. In this rare condition, a meticulous assessment of the patient's neurologic and cardiac status, and careful perioperative anesthetic management were needed in order to avoid life-threatening complications in both intraoperative and postoperative periods.

INTRODUCTION

Myasthenia gravis (MG) is an autoimmune disorder affecting the nicotinic acetylcholine receptor of the post-synaptic membrane of the neuromuscular junction [Vincent 2001]. The destruction or functional block of these receptors is mediated via serum α-subunit of nicotinic acetylcholine receptor antibodies (AChRAb) [Lindstrom 1998]. Up to 20% of patients with typical MG do not demonstrate detectable AChRAb, and are diagnosed as seronegative MG [Yuan 2007]. The cause of MG is still unknown, but in many cases there seems to be a connection with the thymus [Blichfeldt-Lauridsen 2012]. Clinically, the patients show increasing muscle weakness and fatigue with repetitive use, followed by partial recovery with rest [Unterbuchner 2010; Raimond 1984]. A patient with MG who undergoes major surgery requires careful management during and after anesthesia because of unpredictable susceptibility to analgesia and muscle relaxants [Peacock 1989]. To date, however, there have been few reports that describe perioperative management in patients with MG undergoing cardiac surgery [Hayashida 2000; Narin 2009; Ishimura 1998; Asai 2004; Haroun-Bizri 2003]. In this paper, we present a successful coronary artery bypass grafting (CABG) in a patient with MG using cardiopulmonary bypass (CPB).

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CASE REPORT

A 70-year-old (108 kg; 1.70 m; body mass index [BMI] 37.4 kg/m^2) male patient who had occasional episodes of ptosis and skeletal muscle weakness four years prior had been diagnosed with seronegative generalized MG. His MG was classified as Osserman's IIB [Osserman 1971], and treated with oral prednisolone 20 mg daily in the morning, and azathioprine 75 mg twice per day. He was admitted to our hospital with complaints of effort-induced mild chest pain and palpitation. His clinical activity was New York Heart Association class 3, limited by dyspnea and chest pain. A 12-lead electrocardiogram at rest was normal, but he had ischemic ST-T changes on the treadmill exercise test. Cardiac catheterization demonstrated severe three-vessel diffuse coronary artery disease with critical stenosis of the left anterior descending, diagonal, circumflex, and right coronary arteries. The left ventricular ejection fraction was well preserved. The preoperative EuroSCORE II was 2.77%. He was scheduled for elective simultaneous surgical intervention, including extended thymectomy and CABG, using a standard cardiopulmonary bypass.

Prior to the surgery, the neurologic examination revealed normal muscle strength and bulbar system. Respiratory function tests and arterial blood gases were all within normal limits.

The patient was not premedicated, but did receive his usual dose of prednisolone and azathioprine on the morning of surgery. On arrival in the operating room, venous and radial artery catheters were inserted. Intraoperative monitoring included electrocardiography (ECG); pulse oximetry; invasive blood pressure monitoring; capnography; urinary catheter, and body temperature measuring at the nasopharynx. After preoxygenation with 100% oxygen, general anesthesia was induced with intravenous (IV) administration of 0.05 mg/kg midazolam, 1 μg/kg fentanyl, and 1.5 mg/kg propofol. A total of 0.25 mg/kg of rocuronium was administrated until 75-90% neuromuscular blockade was achieved, as evidenced by a neuromuscular transmission monitor (TOF GUARD, BioMeter International, Odense, Denmark) applied to the patient. Neuromuscular monitoring was recorded from the adductor pollicis muscle with train-of-four stimulation of the ulnar nerve. The topical anesthesia was achieved with the use of 4% lidocaine. Then, the tracheal intubation was performed without difficulty. Meanwhile, the general anesthesia was maintained with inhalation of 1.0% sevoflurane, intermittent administration of fentanyl and vecuronium, and continuous infusion of propofol/remifentanil. Propofol and

remifentanil infusions were titrated at 0.7 mg·kg^{-1}·h^{-1} and 2-5 μg·kg^{-1}·h^{-1} respectively, according to the patient's hemodynamic response. A total of 5 μg/kg fentanyl and 0.1 mg/kg vecuronium were also administrated.

Extended thymectomy was performed before CPB. Subsequently, conventional sextuple CABG, using standard CPB, was performed. During CPB, the lowest systemic temperature was maintained at 30 °C and nonpulsatile perfusion flow was kept at 2.4 L/min/m^2. CPB was terminated at a nasopharyngeal temperature of 36.7 °C uneventfully with 3 μgr·kg^{-1}·min^{-1} dopamine infusion. There was no patient movement throughout the procedure. Continuous monitoring of the neuromuscular transmission was maintained throughout the perioperative period.

The patient was transferred to the intensive care unit. Postoperatively, the remifentanil infusion was continued at a rate of 0.5–2 μg·kg^{-1}·h^{-1} to facilitate artificial ventilation and analgesia. No muscle relaxants were used postoperatively. The patient woke up smoothly on stopping the remifentanil infusion. He had good respiratory efforts and was hemodynamically stable. The patient was extubated 4 hours after surgery after fulfillment of the criteria, including maximal inspiratory pressure of 20 cm H_2O and tidal volume of 10 mL/kg. Prednisolone 20 mg IV every 12 to 24 hours was continued until the morning of the second postoperative day, when the patient's normal oral prednisolone and azathioprine regimens were resumed. Postoperative course was uneventful and the patient was discharged from the hospital 7 days after surgery. Pathologic study of the thymus revealed thymic hyperplasia. During the follow-up period, he was evaluated by the same neurologist. Eight months after the operation, his requirement of azathioprine and prednisolone gradually showed a reduction.

DISCUSSION

MG patients, particularly those undergoing major surgery, require special individual preoperative management, appropriate selection and administration of anesthesia, and close monitoring postoperatively [Rudzka-Nowak 2011]. Particularly in patients undergoing trans-sternal surgical procedures such as thymectomy and cardiac surgery, the choice of anesthetic drug and the choice of technique require special consideration, because postoperative pain interferes with pulmonary function, which may already be limited by the disease [Hayashida 2000].

There have been very few reports describing perioperative anesthetic management in MG patients undergoing cardiac surgery [Hayashida 2000; Narin 2009; Ishimura 1998; Asai 2004; Haroun-Bizri 2003]. Some anesthesiologists prefer to avoid muscle relaxants, and use potent inhaled agents both for facilitating tracheal intubation and providing surgical relaxation, whereas some prefer a total intravenous anesthesia [Narin 2009]. Therefore, there is still no unanimity of opinion regarding perioperative general anesthetic techniques.

Maximal neuromuscular blockade is not as necessary during trans-sternal procedures as it is during abdominal surgery, and, so long as the anesthesia is sufficiently deep for the patient to tolerate artificial ventilation, there is no continuing need for muscle relaxant drugs once the chest is opened [Rudzka-Nowak 2011]. In MG patients, the necessary dose depends on the severity of the disease, which calls for individual judgment. It has been reported that roughly 50% of the standard dose is probably adequate, and nearly all patients have a prolonged recovery [Sanfilippo 1997; Paterson 1994; Sungur 2009; Baraka 1999]. Rocuronium, cisatracurium, and vecuronium are all relatively short-acting nondepolarizing neuromuscular blocking agents, and they have a similar effect on MG patients [Blichfeldt-Lauridsen 2012]. Therefore, reduced doses of vecuronium and rocuronium were used as muscle relaxants in our case. Before the intubation, topical lidocaine should be considered to blunt the response to laryngoscopy. Propofol has been shown neither to affect neuromuscular function nor to enhance the blockade from muscle relaxants [Ishimura 1998; McCarthy 1992]. The intravenous anesthesia we used in this patient was with propofol. Moderate doses of fentanyl and reduced doses of muscle relaxants contributed to the overall reduction in the duration of postoperative mechanical ventilation, and prevented the delay of extubation.

Sugammadex is a newly developed agent for the reversal of neuromuscular blockade (NMB) induced by rocuronium or vecuronium. It has been shown that with the use of sugammadex it is possible to reverse a deep neuromuscular blockade quickly, even in MG patients [Unterbuchner 2010; Osserman 1971]. Until now, the cholinesterase inhibitors have been the only option for reversal of NMB. In patients with MG, these drugs have to be used with caution because they can induce a cholinergic crisis, which can be clinically indistinguishable from a myasthenic crisis [Buzello 1986; Hunter 1985].

Thymectomy has been widely accepted by many physicians as an effective treatment for non-thymomatous generalized MG, and is recommended in the myasthenic patient since it may improve the outcome [Yuan 2007, Haroun-Bizri 2003]. CABG and thymectomy are both common procedures carried out via the same median sternotomy approach, and no special surgical technique is required even if performed simultaneously [Asai 2004]. Therefore, we conducted extended thymectomy before CABG. Eight months after the procedure, we achieved pharmacological remission in our patient. This result supports the recommendation of thymectomy in the treatment of patients with generalized MG.

CONCLUSION

In conclusion, we describe the successful perioperative management of a patient with MG undergoing coronary artery bypass surgery. We also suggest that thymectomy be considered routinely, since it may improve the outcome as well.

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