

Off-pump coronary surgery in a patient with multiple sclerosis

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ABSTRACT

Surgery in patients with multiple sclerosis, the most common autoimmune demyelinating disorder of the central nervous system, represents a challenge for surgeons and anesthesiologists because of the reported risk of relapse of the neurologic symptoms in the perioperative period. In this report, we describe the management of a patient with relapsing-remitting multiple sclerosis and critical coronary artery disease, who underwent an uneventful off-pump coronary artery revascularization. The issues pertaining to the performance of coronary surgery revascularization on patients with multiple sclerosis are discussed.

Keywords: anesthesia, body temperature, coronary artery revascularization, demyelinating syndrome, multiple sclerosis, off-pump coronary artery bypass, postoperative bleeding.

INTRODUCTION

Multiple sclerosis (MS) is an autoimmune disorder of the central nervous system, in which focal lymphocytic infiltration leads to damage of myelin and axons (1). The potential mechanisms involved are complex and still not clearly defined, and disease susceptibility is influenced by viral, genetic, and environmental factors (1).

In over half of patients, MS is characterized by a relapsing-remitting trend, with exacerbation of clinical manifestations, followed by periods of stabilization and amelioration of symptoms. This condition represents a challenge for the anesthesiologists and the

surgeons because of the risks of relapse of symptoms in the perioperative period.

In the following report we elaborate on the perioperative management of a patient with MS, finalized to prevent the relapse of symptoms, who underwent uneventful off-pump coronary artery revascularization, and we discuss the issues pertaining to the performance of cardiac surgery on patients with this disease.

CASE REPORT

A man with a history of smoking 20 cigarettes per day, hypercholesterolemia and arterial hypertension was admitted to our center for diagnostic evaluation of recurrent episodes of angina. Five years previous to this admission he had an acute inferior myocardial infarction that had been treated

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with thrombolysis and stent implantation in the right coronary artery.

Past medical history was significant due to MS, which had been diagnosed four years prior to admission by extensive neurological investigation following the development of paresthesia on the left frontal side of the head. Magnetic resonance imaging (MRI) of the brain showed numerous ovoid and confluent hyperintense lesions in the white matter of periventricular and subcortical areas and basal nuclei, with few areas of enhancement interpreted as active lesions.

MS was diagnosed, and he was initially treated with high-dose interferon β . In the following years, the disease showed relapsing-remitting characteristics, with occurrence of spastic paraparesis of the four limbs and of inter-nuclear ophthalmoplegia with horizontal diplopia. Due to the emergence of hepatic steatosis, interferon β dosages were reduced with worsening of symptoms, including right hemiparesthesia and hemiparesis partially responsive to high-dose cortisone. Manic depression ensued and was treated with alprazolam and paroxetine.

On admission a dobutamine stress echocardiogram resulted positive for inducible angina. Coronary angiography showed intrastent stenosis of the right coronary artery and critical stenosis of the proximal left descending coronary artery. Trans-thoracic echocardiography showed no cardiac valvulopathy, and preserved left ventricular ejection fraction.

Neurologic examination and an MRI of the brain showed that a progression of the MS disease was not evident and the patient was scheduled for surgical coronary artery revascularization.

Preoperative routine monitoring of laboratory and respiratory parameters showed only a modest reduction of pulmonary function (FEV1 91%) and moderate hy-

percipnia (resting arterial carbon dioxide tension 48 mmHg).

On the day of surgery, a fast-track cardiac anesthesia protocol was applied: anesthesia was induced with propofol, $2 \text{ mg} \cdot \text{kg}^{-1}$, and fentanyl, $1.5 \text{ } \mu\text{g} \cdot \text{kg}^{-1}$. Tracheal intubation was facilitated by vecuronium administration ($0.1 \text{ mg} \cdot \text{kg}^{-1}$). Maintenance of anesthesia was obtained with propofol infusion at $4\text{-}6 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{h}^{-1}$, and bolus doses of fentanyl (total dose of 0.5 mg), vecuronium (total dose of 15 mg), and midazolam (total of 5 mg). Prior to skin incision metilprednisolone ($15 \text{ mg} \cdot \text{kg}^{-1}$) was administered, and tranexamic acid infusion was started at previously described doses (2) to prevent excessive bleeding. During surgery, cerebral oxygenation was monitored non invasively with a cerebral oxymeter (Invos System, Somanetic Corporation, Michigan, USA). Temperature was closely monitored using pharyngeal and urinary temperature probes.

The patient was operated on through full median sternotomy utilizing the off-pump technique. A heparin dose of $150 \text{ IU} \cdot \text{kg}^{-1}$ was administered to obtain an activated clotting time (ACT) greater than 250 seconds. No drugs were administered to control the heart rate.

The skeletonized left internal mammary artery (LIMA), isolated through an extrapleural approach in order to avoid the potentially harmful effects of pleural lesions on pulmonary function, was anastomosed to the left anterior descending coronary artery. The right coronary artery was bypassed utilizing the left radial artery, proximally anastomosed to the ascending aorta. At the end of coronary revascularization, heparin was antagonized with a protamine dose of 150 mg, which normalized the ACT. Meticulous surgical hemostasis was performed in order to reduce the risk of postoperative bleeding and the need for allogeneic transfusions.

In the postoperative period propofol infusion ($2 \text{ mg} \cdot \text{kg}^{-1}$) was continued for about 3 hours to avoid shivering, with no additional administration of muscle relaxant drugs. Strict control of the body temperature was continued during the gradual interruption of sedation; the patient was awakened and weaned from the ventilator and the tracheal tube was removed 5 hours after returning from the operating room, with stable haemodynamic and respiratory parameters and no signs of excess bleeding.

The postoperative period was uneventful. On the first postoperative day the blood lost in the drainage tubes amounted to 300 ml and the drains were removed. The patient was transferred to the ward on the second postoperative day and to the Rehabilitation Unit of our Hospital on the sixth postoperative day with no signs of exacerbation of MS symptoms.

At the follow-up, the patient is asymptomatic for angina. Mild relapsing-remitting symptoms of MS have continued to occur, positively reacting to interferon β and cyclic high-dose cortisone administration; trigeminal neuralgia which proved unresponsive to pregabalin was treated with gabapentin with positive results.

DISCUSSION

Very few reports on cardiac surgery in patients with MS have been published (3-5) and, to the best of our knowledge, this is the first description of the management of a patient with MS undergoing coronary artery surgery.

MS is a progressive demyelinating syndrome, in which the central nervous system is attacked by the immune system. Particularly, the destruction of oligodendrocytes, the cells responsible for creating and maintaining the myelin sheath, determines the degeneration of the white matter both

in areas of the brain and the spinal cord (1). Taking a number of considerations into account regarding the risk of MS relapse symptoms in our patient, we elected to perform the coronary revascularization procedure employing an off-pump technique. Firstly, hyperthermia ranks among the major causes of MS postoperative relapse by slowing conduction in demyelinated nerves (1). On-pump coronary bypass surgery (ONCABG) is frequently characterized by active manipulation of the temperature, with cooling at the beginning and re-warming at the end of the extracorporeal circulation, which may lead to hyperthermia in the postoperative period (6). Off-pump coronary artery bypass (OPCABG) can significantly reduce hyperthermia when compared to standard ONCABG (7). Moreover, extracorporeal circulation is associated with a greater activation of inflammation (2, 8), another important cause of postoperative increase in body temperature. Cardiopulmonary bypass also carries an increased risk of postoperative neurologic complications and cognitive dysfunction (7,8) as a result of cerebral microembolization, hypoperfusion, cerebral edema, and blood-brain barrier disruption, which may all have amplified effects in MS patients. Finally, OPCABG carries per se an inferior requirement for allogeneic transfusions compared to ONCABG (9), and this is of great importance, as febrile non-hemolytic and allergic transfusion reactions are not uncommon (10). Furthermore, with the aim to reduce the risks of excessive bleeding, and consequently the need for allogeneic transfusions, in this patient we successfully used our standard protocol for tranexamic acid (2) paying particular attention to recent reports which have identified a relationship between high-dose tranexamic acid and the incidence of postoperative seizures (11), even though not encountered in our own large experience (12). While surgical

stress and physical trauma per se have not been indicated as direct cause of relapse of MS, the relationship between psychological stress due to surgery and MS exacerbation is deemed possible (13).

Finally, anesthesia has been often implicated as cause of exacerbation of the MS symptoms (14). There is no clear relationship between the administration of a specific anesthetic drug and exacerbation of MS, but attention must be paid to the selection of neuromuscular blocking drugs. In fact, in patients with denervation pathology, administration of succinylcholine may induce hyperkalemia, due to the excessive release of intracellular potassium. In addition, patients with MS show increased sensitivity to the effects of non depolarizing muscle relaxants (13). Central and/or spinal lesions affecting inspiratory centers, or reduced motor function, may all cause an alteration in respiratory functions. In fact, in patients with MS in whom standard preoperative exams only show a modest reduction of the forced vital capacity and moderate hypercapnia, published reports have demonstrated that a more specific examination may reveal severe pulmonary dysfunction even in the absence of any respiratory symptoms (15), with the theoretical increased risk of severe postoperative pulmonary complications. The selection of a balanced total intravenous anesthesia, with the use of low dose opioids and benzodiazepine, infusion of propofol, and vecuronium as muscle relaxant with a relative short half-life, allowed a fast-track approach and the early extubation in the postoperative period in our patient.

In conclusion, a careful preoperative evaluation and selection of surgical and anesthet-

ic protocols resulted in safe management of a patient with MS requiring coronary revascularization, avoiding the risk of MS relapse.

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