J Anesth (2006) 20:227–230
DOI 10.1007/s00540-006-0407-8

Journal of
Anesthesia

Anesthetic management of a patient with a history of Batista procedure for dilated cardiomyopathy undergoing gastric surgery

Aki Honda, Tamie Arai, Maki Akiyama, Eriko Masuda, Mizuka Kobayashi, and Sumio Hoka

Department of Anesthesiology, Kitasato University School of Medicine, 1-15-1 Kitasato, Sagimahara 228-8555, Japan

Abstract
We experienced anesthetic management for an operation to remove a hemorrhagic gastric submucosal tumor in a patient who had undergone left ventricular volume reduction (the Batista procedure) for dilated cardiomyopathy (DCM) 2 years previously. Preoperative evaluations indicated the relapse of severe DCM. Intravenous and epidural anesthesia was employed with the aid of an intraaortic balloon pump (IABP). Safe anesthetic management was achieved under the guidance of a Swan-Ganz catheter without inducing overreduction of afterload or excessive preload.

Key words Anesthetic management · DCM · Batista procedure · Swan-Ganz catheter

Introduction

The Batista procedure has received a considerable amount of attention as a drastic method of treatment for severe DCM, by increasing cardiac contractile force due to the partial removal of the enlarged left ventricle wall [1]. Because these patients could die while waiting for a heart transplant [2], the procedure is used as an alternative or bridge to heart transplantation. The procedure has been reported to have been carried out in only a few hundred patients worldwide [3]. There are even fewer reports of anesthetic management for patients who have undergone the Batista procedure. We successfully managed such a patient who was undergoing excision of the gastric mucosa, by general anesthesia combined with epidural anesthesia, using a Swan-Ganz catheter.

Address correspondence to: S. Hoka
Received: January 4, 2006 / Accepted: April 10, 2006

Case report

A 62-year-old man (height, 162 cm and weight, 49 kg) was scheduled to undergo an operation for excision of the gastric cardia to remove a hemorrhagic gastric submucosal tumor for which endoscopic hemostasis was not indicated. Preoperative problems were cardiac dysfunction, chronic renal failure, anemia, and hypoproteinemia.

Cardiac dysfunction. The patient had been diagnosed with DCM New York Heart Association (NYHA) class IV, at the age of 53 and had suffered ongoing heart failure. At the age of 60, he underwent a partial left ventriculectomy as a Batista procedure, in addition to mitral and tricuspid valvuloplasty. After the operation, he had been treated with a β-blocker, a calcium channel antagonist, and a diuretic, without significant heart failure (Fig. 1). His cardiac function on presentation was classified as NYHA class III. An electrocardiogram revealed negative T waves in V4-6, and a prolonged QT interval of 0.502 s. An echocardiogram showed left ventricular and atrial dilatation, and detected severe hypokinesis to akinesis all around the left ventricle, and an ejection fraction of 24%. The left ventricular dimensions in systole and diastole were 70 mm and 59 mm, respectively. The thickness of the posterior wall and intraventricular septum was 6.7 mm and 8 mm, respectively. Mitral and tricuspid regurgitation was classified as II–III.

Chronic renal failure. The patient was diagnosed with chronic renal failure secondary to diabetes mellitus. He received peritoneal dialysis and the glycemia was fairly well controlled.

Anemia and hypoproteinemia. Anemia (hemoglobin [Hb], 8.3 g/dl) and hypoproteinemia (total protein [TP], 5.4 $g \cdot dl^{-1}$) resulted from gastric hemorrhage. To avoid

Fig. 1. Chest X-ray, showing no signs of heart failure

sudden infusion loads to maintain hemodynamic stability during surgery, the patient was transfused, and administered with albumin solution, aiming to achieve Hb, 10 g/dl; hematocrit (Hct), 35%, and TP, 6 $g \cdot dl^{-1}$ before the operation.

Transesophageal echocardiography (TEE) could not be used because of the surgical site, so a Swan-Ganz catheter was used to monitor the preload, afterload, and cardiac function. The patient was given an oral administration of 2 mg diazepam 90 min before the operation. An epidural catheter was placed at Th 7/8 and 2 ml of 1% mepivacaine was given as a test dose. The administration of 0.4 $\mu g \cdot kg^{-1} \cdot min^{-1}$ of nitroglycerin and 2 $mg \cdot h^{-1}$ of nicorandil was commenced. The right radial artery and right internal jugular vein were cannulated for Swan-Ganz catheter under local anesthesia. An intraaortic balloon pump (IABP) was subsequently inserted through the right femoral artery and driven in 1:1 mode. Anesthesia was induced by midazolam 3 mg, fentanyl 400 µg, and vecuronium 6 mg, and tracheal intubation was successfully performed without hemodynamic fluctuations. Anesthesia was maintained with 3 $mg \cdot kg^{-1}/h^{-1}$ of propofol and fentanyl with air and oxygen. To maintain cardiac contractility, 3 $\mu g \cdot kg^{-1} \cdot min^{-1}$ of dopamine and 0.2 $\mu g \cdot kg^{-1} \cdot min^{-1}$ of olprinone were commenced before the start of the operation. Although 12 $\mu g \cdot kg^{-1}$ of fentanyl had already been administered, immediately after the start of the operation, the patient's blood pressure increased from 95/45 to 145/75 mmHg and his heart rate rose from 58 to 68 beats per min. Six ml of bupivacaine 0.125% was therefore given epidurally, which lowered the blood pressure to 85/45 mmHg, but raised the heart rate to 80 beats per min. Simultaneously, the peripheral vascular resistance decreased from 3201 to 1137 dyn s/cm^5, and the pulmonary capillary wedge pressure (PCWP) decreased from 12 to 7 mmHg. The patient was therefore given albumin and concentrated red cells, which gradually improved the PCWP to 10 mmHg and increased the cardiac index from 2.2 to 4l per min per m^2. After this, his blood pressure rose once again, from 90/56 to 125/55 mmHg, and heart rate increased from 80 to 105 beats per min; therefore another 6 ml of bupivacaine (0.0625%) and 100 µg of fentanyl were given epidurally. However, because the tachycardia persisted, a further 6 ml of bupivacaine 0.0625% was administered 5 min later. His heart rate subsequently reached 90 beats per min, so he was given 4 ml of bupivacaine 0.0625% and 50 µg of fentanyl epidurally. Thus, his blood pressure and heart rate stabilized, in the ranges of 95–110/45–55 mmHg and 70–80 beats per min, respectively. The operation ended without complications. Continuous epidural infusion of 54 ml of bupivacaine 0.0625% and 300 µg of fentanyl was commenced, at 2 $ml \cdot h^{-1}$, 30 min before the end of the operation. The blood loss was 55 g, the urine output was 100 ml, and the total infusion volume was 1270 ml. The patient was returned to the intensive care unit (ICU) without extubation, when his cardiac index was 4.8l per min per m^2.

Four hours after his return to the ICU, the patient developed tachycardiac atrial fibrillation, with the heart rate rising to 150 beats per min. His blood pressure had also become unsteady, so cardioversion was commenced at 50 J. Because sinus rhythm was not obtained, the cardioversion was repeated, increasing the energy to 100 J, 150 J, and 200 J. Digoxin and disopyramide were also administered. Although the atrial fibrillation persisted, his heart rate stabilized in the range of 90–100 beats per min.

On the day of the operation, hemodialysis was performed, and extubation was successfully performed 2 days after the operation. Following extubation, he developed atrial flutter with 2:1 block, and cardioversion was carried out once again. The heart rate subsequently stabilized, but the atrial fibrillation continued. On day 3 after the operation, the IABP was removed. On day 4, both the Swan-Ganz and the epidural catheters were removed. The patient was discharged 51 days after the operation.

Discussion

The 2-year survival rate was reported to be 55% in 120 patients who received the Batista operation. Although most of them recovered to either NYHA I (57%) or II (33.3%), 1 patient suffered a relapse of left ventricular dilatation and subsequently received a heart transplant. Progression of cardiac disease and insufficient excision

of the left ventricular wall were cited as reasons for the relapse [1]. However, the long-term prognosis and rate of relapse of left ventricular dilatation following the Batista procedure have yet to be elucidated. In our case, the patient had undergone the Batista procedure 2 years previously. However, preoperative cardiac function showed cardiac dilatation and decreased cardiac contractile force, necessitating stringent anesthetic management, equivalent to that for a DCM patient. Patients with DCM have a high incidence of sudden death and death from cardiac failure, with a 5-year survival rate of 50%.

The most important aspects of cardiac management for patients with DCM are maintenance of cardiac contractile force, adequate preload, and appropriate afterload reduction. There are many reports of TEE being effective for monitoring infusion and cardiovascular management during surgery, because it permits the evaluation of left ventricular dimension, fractional shortening, and regional wall motion noninvasively. Additionally, its usefulness in determining the applicability of left-ventricular assist devices was also reported [4]. In our patient, because TEE could not be used, a Swan-Ganz catheter was used for hemodynamic monitoring to evaluate cardiac function. Cardiac contractile force was evaluated by monitoring continuous cardiac output, preload was evaluated by monitoring the PCWP and the central venous pressure, and afterload was evaluated by monitoring the peripheral vascular resistance. Although ventricular regional wall motion could not be observed, cardiac function could be monitored quantitatively, which facilitated safe cardiovascular management.

Comparatively few anesthetic methods have been reported for DCM patients. Intravenous anesthesia is most frequently selected, especially with agents such as fentanyl and midazolam, because they do not induce myocardial depression or vasodilation [5,6]. This anesthetic method is also recommended for heart transplant recipients.

While inhalation anesthesia has the advantage of being easily adjustable, making rapid hemodynamic changes simple, it may be contraindicated because of its strong myocardial depressive and vasodilatory effects. However, inhalation anesthesia at a low concentration (0.5–1 minimum alveolar concentration [MAC] with a low dose (2–3 $\mu g \cdot kg^{-1}$) of fentanyl can be safely used without a decrease of cardiac contractile force [7].

Epidural anesthesia is beneficial for afterload reduction and postoperative analgesia [8]. However, extensive sympathetic nerve block and a drastic reduction in afterload, which, in turn, causes reduction of preload, can make the maintenance of cardiac output difficult in patients with cardiac failure. Consistent with these changes, a high dose of catecholamine and a large infusion load may exacerbate congestive heart failure. To avoid rapid and extensive sympathetic nerve block in patients with DCM, Echigoya and Igarashi [9] administered a low dose ($2 ml \cdot kg^{-1}$) of mepivacaine continuously with an infusion pump, while Hashimoto et al. [10] administered $10 \mu g \cdot kg^{-1}$ of fentanyl epidurally. There were no significant hemodynamic changes during abdominal surgery in either patient, and satisfactory analgesia was achieved in both. The course of anesthesia, including the postoperative period, went well in our patient. Preoperatively, we planned that epidural anesthesia was chiefly intended for postoperative use to prevent painful sympathetic nerve stimulation and tachycardia, resulting in increases in afterload and cardiac oxygen consumption. However, epidural fentanyl was used concomitantly during surgery, as suppression of the pain response could not be achieved with intravenous anesthetics alone. It is considered that the safe concomitant use of epidural anesthetics was achieved during surgery without hemodynamic collapse because: (i) excessive sympathetic nerve block and reduction of afterload were successfully avoided by the low concentration of local anesthetics and low-dose narcotics given only to compensate for the insufficient response to intravenous anesthetics, (ii) preload could be appropriately corrected with the Swan-Ganz catheter data. A few hours after being returned to the ICU, the patient developed hypotension from fluid insufficiency and also suffered bouts of atrial fibrillation, which required defibrillation treatment several times. Because hemodynamic collapse can occur in patients with low cardiac reserve and moderate fluid insufficiency and because they are apt to show severe arrhythmia [11], the results with this patient reaffirmed to us the extreme importance of stringent infusion management during and after surgery.

In conclusion, we have described anesthesic management for a patient with severe DCM status after the Batista procedure. In order to minimize perioperative pain, which has an impact on the cardiac circulation, concomitant use of epidural anesthesia with strict monitoring enabled by the use of a Swan-Ganz catheter, may outweigh the risk of hypotension caused by the use of epidural anesthesia.

Acknowledgments. We thank Urita Miyuki and Toshihiro Ishikawa, Information Center of Kitasato University School of Medicine, for their help.

Reference

1. Batista RJ, Verde J, Nery P, Bocchino L, Takeshita N, Bhayana JN, Bergsland J, Graham S, Houck JP, Salerno TA (1997) Partial left ventriculectomy to treat end-stage heart disease. Ann Thorac Surg 64:634–638

2. Aronson SL, Hensley FA Jr (1998) Anesthetic considerations for the patient undergoing partial left ventriculetomy (Batista procedure). J Cardiothorac Vasc Anesth 12:101–110
3. Kawaguchi AT, Isomura T, Konertz W, Gradinac S, Dowling RD, Kitamura S, Bergsland J, Linde LM, Koide S, Batista RJ; International Registry Task Force: The Society for Cardiac Volume Reduction (2003) Partial left ventriculectomy: the third International Registry report. J Card Surg 18:S33–42
4. Nakatani T, Sasako Y, Kobayashi J, Komamura K, Kosakai K, Nakano K, Yamamoto F, Kumon K, Miyatake K, Kitamura S, Takano H (1998) Recovery of cardiac function by long-term left ventricular support in patients with end-stage cardiomyopathy. ASAIO J 44:M516–520
5. Oguchi T, Kashimoto S, Kanda F, Kumazawa T (1991) Anesthetic management of dilated cardiomyopathy with severe ventricular dysrhythmias. Eur J Anaesthesiol 8:301–304
6. Kaplan JA, Reich DL, Konstadt SN (eds) (1993) Heart and heart-lung transplantation; cardiac anesthesia, vol 3, WB Saunders, Philadelphia, pp. 905–916
7. Stevens WC, Cromwell TH, Halsey MJ, Eger EI 2nd, Shakespeare TF, Bahlman SH (1971) The cardiovascular effects of a new inhalation anesthetic, Forane, in human volunteers at constant arterial carbon dioxide tension. Anesthesiology 35:8–16
8. Amaranath L, Esfandiari S, Lockrem J, Rollins M (1986) Epidural analgesia for total hip replacement in a patient with dilated cardiomyopathy. Can J Anesth 33:84–88
9. Echigoya Y, Igarashi A (1996) Anesthetic management of a patient with dilated cardiomyopathy. J Clin Anesth 23:255–256
10. Hashimoto K, Ooka T, Kosaka Y (1994) Epidural anesthesia with high dose fentanyl for a patient with dilated cardiomyopathy (in Japanese with English abstract). Masui (Jpn J Anesthesiol) 43:1881–1884
11. Dec GW, Fuster V (1995) Idiopathic dilated cardiomyopathy N Engl J Med 332:1384–1386