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Anesthesia in a Patient with Dilated Cardiomyopathy Using Sevoflurane

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Dilated cardiomyopathy (DCM) is a myocardial disease of unknown etiology, which is associated with a poor prognosis. The ventricular dilation and systolic dysfunction observed are due to degeneration and fibrosis of myocardial cells. It is important during anesthesia in patients with DCM to avoid depression of cardiac contractility, control arrhyhmias and prevent acute heart failure. When using anesthesia for DCM patients, generally, narcotics are recommended due to their minimal effects on myocardial contractility. In our case, we selected an inhalation anesthetic agent, sevoflurane and then evaluated whether sevoflurane is acceptable anesthetic agent or not for the management of DCM.

Key Words: Dilated Cardiomyopathy, Sevoflurane, RVEF-Swan-Ganz Catheter

Case Report

A 42-year-old male, weighing 55 kg and with a height 161 cm, developed exertional palpitations 2 years prior to this operation. The diagnosis of DCH was made based on detailed examination by a local physician. He had received outpatient medical treatment since the time of diagnosis. Towards the end of April 1990, the patient developed dyspnea and orth opnea and was admitted to another hospital on an emergency basis. Endotracheal intubation and administration of exogenous catecholamines were required at one point to improve severe acute heart failure. Unfortunately, renal cell carcinoma of the left kidney was detected during that hospitalization, and the patient was transferred to the Department of Urology at our hospital for surgical removal of the kidney. Oral medications at the time of admission included nifedipine, furosemide, digoxin, prazosin, captopril, and potassium gluconate. Preoperative evaluation revealed nomal blood count, and pulmonary, kidney and liver functions. Blood pressure was 130-140/40-50 mmHg and heart rate was 65-75/min with a Levine II systolic and diastolic murmur at the 2nd intercostal space at the LSB. NYHA classification was III. Chest X-ray revealed cardiomegaly with CTR of 66%. ECG revealed left ventricular hypertrophy. Exercise ECG showed mild ST depression in V_{4-6}. Echocardiography revealed marked left ventricular dilation and mild left atrial dilation. Left ventricular diastolic wall diameter (LVDd) was 58 mm, indicating dilation, and anterior ventricular wall motion was hypokinetic. Aortic regurgitation (AR) was observed, with an ejection frac-

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tion (EF) of 36% and a high cardiac index (CI) of 3.13 L/min/m^2. After sufficiently explaining the surgical risk and obtaining informed consent from the patient and family, left nephrectomy was scheduled.

Course of anesthesia

Scopolamine (0.4 mg), hydroxyzine (50 mg), and butorphanol (1 mg) were given intramuscularly as premedications. Left radial artery cannulation was performed under local anesthesia. Before induction of anesthesia, a quadruple-lumen balloon flotation pulmonary artery catheter mounted with a fast response (95-msec) thermistor (Swan-Ganz Thermodilution Ejection Fraction/Volumetric catheter, Model 93A-431H-7.5 Fr, Baxter/Edwards Critical-Care Division, Santa Ana, CA) was inserted via the right internal jugular vein. Proper positioning was confirmed before each measurement. At this point, the arterial blood pressure was 170/90 mmHg, heart rate was 70/min, mean pulmonary arterial pressure (PAP) was 24 mmHg, cardiac index (CI) was 2.61 L/min/m^2, and right ventricular EF was 33%.

Anesthesia was induced with 10 mg of midazolam, 8 mg of vecuronium bromide and 100 mg of 2% lidocaine. Anesthesia was maintained with 60% nitrousoxide, 40% oxygen and sevoflurane (0.6-1.5%) and vecuronium bromide as a muscle relaxant. Prostagrandin E_1 and nitroglycerin were administerd to decrease the afterload and preload. During the operation, hypertension (160-180/60-80 mmHg) and bradycardia-tachycardia ranging between 38 and 105 bpm were observed. A dose of 2 mg of nicardipine was administered by bolus injection for hypertension and 0.5 mg of atropine sulfate was given for bradycardia. Table 1 shows the time course of hemodynamic parameters in this case during the operation.

Blood loss during surgery was 550 g. Urine output was 300 m*l* and 2000 m*l* of lactate Ringer's solution was infused during surgery. The operation lasted 2 hours and 20 minutes and was without complications. The patient was transferred to ICU postoperatively for further monitoring and care.

Discussion

Idiopathic cardiomyopathy is classified into

Table 1 The Changes of Hemodynamics During Surgery

		Pre Anesthesia	Anesthesia	Post Nephrectomy	End of surgery
ABP	mmHg	170/90	143/78	168/88	140/72
HR	bpm	70	64	58	82
PAP	mmHg	47/12	22/12	24/12	29/12
PCWP	mmHg	12	9	11	8
RAP	mmHg	8	6	7	8
RVEF	%	33	29	30	35
CI	*l*/min/m^2	2.61	2.36	3.10	2.78

Abbreviations:
ABP; Arterial blood pressure
HR; Heart rate
PAP; Pulmonary arterial pressure
PCWP; Pulmonary capillary wedge pressure
RAP; Right atrial pressure
RVEF; Right ventricular ejection fraction
CI; Cardiac out put index

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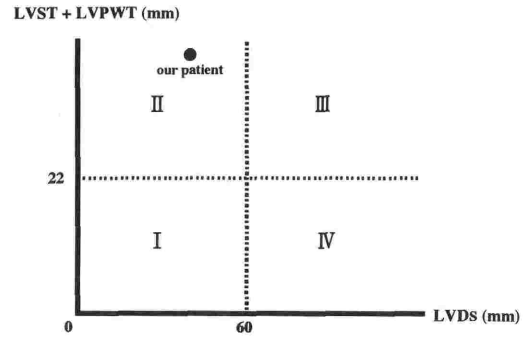
three types: hypertrophic type (HOCM), dilated type (DCM) and restrictive type (RCM)[1]. Unlike HOCM, which is primarily chacacterized by insufficient diastolic filling, DCM is characterized by insufficient cardiac contractility resulting in a rise in myoocardial filling pressure, increased systemic vascular resistance and decreased cardiac output[2)3)]. In patients with heart disease undergoing non-cardic surgery, ventricular wall motion and left ventricular EF are used as the basis for deciding the safety of anesthesia and surgery. Anesthesia is thought to be possible when the EF is higher than 0.4. However, the presence of other disease, symptoms of heart failure and functional abnormalities of other organs may complicate the clinical situation. The decision regarding the indications for surgery and anesthesia is frequently difficult. DCM is often complicated by arrythmias and thromboembolic phenomena and is associated with high mortality[2)]. Inao et al.[4)] measured total myocardial thickness-septal thickness (IVST), left ventricular posterior wall thickness (LVPWT), and left ventricular systolic diameter (LVD) and created a classification for this disease (Fig. 1). Groups III and IV had LVDs greater than 60 mm, and Groups I and II had LVDs less than 60 mm. Those with IVST and LVPWT greater than 22 mm were defined as Groups II and III, and those with lower values as Groups I and IV. Because of the associated high mortality rates, elective surgery should not be performed in Groups I and IV. No deaths due to heart failure occurred in Groups II and III of that report[4)]. Since our case belonged to Group II, according to the classification of Inao, surgery was thought to be feasible. We felt that surgical stress should be kept to a minimum, and that this would necessitate careful anesthetic management.

The anesthesia for HOCM is mainly based on inhalation anesthetics combined with beta-blockers due to the necessity to avoid drugs



Abbreviations :
LVDs ; Left ventricular systolic diameter
LVST ; Total myocardial thickness - septal thickness
LVPWT ; Left ventricular posterior wall thickness

Fig. 1 Inao's classification for dilated cardiomyopathy is demonstrated. (●) shows our case which is reported in this paper.

that increase cardiac contractility[3)5)]. Conversely, inhalation anesthetics markedly suppress myocardial contractility and are contraindicated in patients with DCM. In DCM, narcotics are primarily recommended as anesthetic agents[2)3)5)].

Sevoflurane, an inhalation anesthetic theoretically contraindicated for DCM, decreases mean arterial pressure in a dose-dependent manner. While sevoflurane decreases stroke volume, an increase in heart rate limits the decrease in cardiac output. Sevoflurane decreases left ventricular contractility, but maintains left ventricular performance, decreases peripheral vescular resistance, and dilates coronary blood vessels[6)]. Therefore, sevoflurane appeared to be a potentially beneficial anesthetic agent in our case, which was complicated by hypertension, congestive heart failure and coronary arteriosclerosis. We felt that sevoflurane should be used in conjuction with a narcotic, such as fentanyl. We believe that sevoflurane is superior to isoflurane or halothane from the view point of antiarrhythmogenic effect[7)]. Sevoflurane was used for the maintenance of anesthesia without problems in our case. The use of vasodilators is reported to be effective in decreasing afterload and preload[8)]. But, excess

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or rapid fluid supplementation should be avoided. In cases complicated by aortic regurgitation such as our case, increased myocardial wall tension as the result of increased backflow into the left ventricle causes myocardial ischemia and decreases cardiac output. Therefore, intraoperative control of peripheral vascular resistance is important[9]. Since biventricular failure occurs in DCM, the role of the right ventricle in maintaining pulmonary cirulation cannot be ignored. In our case, simultaneous measurement of hemodynamics and right ventricler ejection fraction (RVEF) using the thermodilution method with a Swan-Ganz catheter was employed to monitor cardiac function. In our study, RVEF was favorably maintained using sevoflurane anesthesia, suggesting the usefulness of sevoflurane are as an anesthetic for patients with DCM.

In general, decreased right side cardiac function results from conditions associated with an increase in afterload, such as acute respiratory failure and right ventricular myocardial ischemia and infarction. The possibility of decreased left ventricular pump function due to a decline in left ventricular preload resulting from decreased right ventricular function has been suggested[10)-12)]. RVEF monitoring permits early detection of changes in right ventricular perfomance, allowing prevention of these deleterious changes in cardiac load and further declines in cardiac function.

Our conclusion is the following. For successful perioperative management in patients with DCM, sevoflurane was acceptable, and RVEF was a useful parameter for monitoring hemodynamics during surgery.

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