Anesthetic Management of the Patient with a History of Kawasaki Disease — A Report of 19 Cases

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It is sometimes necessary to anesthetize children with Kawasaki disease in order to perform surgery for complications of the disease, e.g., aortocoronary bypass surgery[1,2], mitral valve replacement[3] and operations against biliary tract and bowel involvement[4]. However, more cases with a history of Kawasaki disease are candidates for general operation. Guidelines for general anesthesia in cases with a history of Kawasaki disease have not been established.

We report 19 patients with a history of Kawasaki disease who underwent general anesthesia.

Case reports

Twenty out of 4256 patients (excluding those who underwent cardiac catheterization) had a history of Kawasaki disease in which general anesthesia was performed between January 1981 and December 1988. One of them was a case of pericardiocentesis in the acute phase of Kawasaki disease and was excluded from this report. The 19 patients ranged in age from 6 months to 8 years; 15 patients were male and 4 were female. All of them had fulfilled the criteria for Kawasaki disease[5]. They had been started on oral administration of aspirin (30 $mg \cdot kg^{-1} \cdot day^{-1}$) as an antiinflammatory and anticoagulant agent right after the diagnosis had been made. Complications of Kawasaki disease in the acute phase are summarized in the table 1. Abnormal dilatation of the coronary artery was found by two-dimensional (2D) echocardiography in 7 patients in the acute phase but no stenotic coronary lesion was observed. These dilated lesions were classified according to the degree of coronary arterial diameter into coronary dilatation (enlargement of the coronary artery less than 1.5 times that of the uninvolved segment) and coronary aneurysm (dilatation of coronary arterial diameter more than 1.5 times that of the adjacent normal segment). In 11 cases, increases in serum GOT or GPT levels of more than 50.U/L (Henry method) had been noted in the acute phase of the disease. In 6 of these cases, the increases in serum GOT and GPT levels was noted after aspirin administration was started and normalized within 5 to 24 days after aspirin was withdrawn. In the other 5 cases, liver dysfunction was noted before the commencement of aspirin administration and was considered to be related to Kawasaki disease itself. Aspirin administration had been discontinued at least 3 months before surgery in all cases. Preoperative evaluation of the patients disclosed no abnormality in liver function.

The operations (table 1) included herniorrhaphy, ganglion resection, cholecystectomy, mole resection, phimosis formation, endoscopic retrograde cholangiopancreatography and appendectomy. The period from the onset of Kawasaki disease to surgery was as

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follows: 6 months to 1 year in 6 cases, 1 to 2 years in 4 cases, 2 to 3 years in 4 cases and more than 3 years in 1 case.

Blood cell count, blood chemistry, electrocardiogram and chest roentogenogram were evaluated in routine preoperative examinations. Abnormal Q waves on electrocardiogram were noted in 2 cases. 2D echocardiography and exercise electrocardiogram (Master's two-step test) were performed preoperatively in 7 cases with a history of cardiac involvement in the acute phase of Kawasaki disease. In case No. 2, Q waves were noted in leads III and aV_F on the electrocardiogram and aneurysms of the right coronary artery (6 mm in diameter) and left anterior descending artery (15 mm in diameter) were observed. However, selective coronary arteriography (CAG) disclosed no significant stenotic lesion in the patient.

Thirty minutes before induction of anesthesia, atropine sulfate (0.02 $mg \cdot kg^{-1}$) was administered intramuscularly in all cases. Anesthesia was induced with a mixture of oxygen, nitrous oxide and halothane (3L/6L and 2.5%) via a facemask in 16 cases and with intravenous sodium thiopental (5 $mg \cdot kg^{-1}$) in the other 3 cases. The trachea was intubated in 17 cases by administration of intravenous pancuronium bromide (0.1 $mg \cdot kg^{-1}$). Anesthesia was maintained using a mixture of oxygen and nitrous oxide (2L/4L inspired mixture) with additional halothane or intravenous pentazocine. Respiration was maintained by assisted or controlled ventilation.

Cardiac rate, rhythm and breath sound were monitored continuously by a precordial stethoscope and leads II and V_5 of the electrocardiogram. A cuff sphygmomanometer was applied to measure arterial blood pressure and a pulse oximeter was used for evaluation of arterial blood oxygen saturation during the operations. Neostigmine (0.1 $mg \cdot kg^{-1}$) and atropine sulfate (0.03 $mg \cdot kg^{-1}$) were administered intravenously before tracheal extubation.

In all cases, hemodynamics were maintained throughout the operations and no patient showed complications related to anesthesia, including liver damage by halothane.

The clinical features and methods of anesthesia in the 19 patients are summarized in the table.

Discussion

Kawasaki disease is a systemic angitis, which affects mainly children under 4 years of age and sometimes causes sudden death[6]. Since the first description by Kawasaki in 1967[7], more than 83,000 cases have been reported in Japan[8]. Although the mortality rate of the disease has been decreased to 0.14%[8] by improved medical treatment, many issues remain unsettled concerning general anesthesia in patients with a history of Kawasaki disease. These include the time when anesthesia can safely be given following the acute phase of the disease, necessary and sufficient preoperative examinations and the schema of anesthesia.

All 19 cases reported in this paper received general anesthesia more than 6 months after the onset of Kawasaki disease. Coronary involvement in the acute phase of the disease can cause rupture of coronary aneurysm and myocardial infarction due to thrombotic obstruction of the coronary artery[9]. Kawasaki reported that the incidence of coronary aneurysm was 40–45% in the acute phase but decreased to less than 5% in a year[10]. Regression of coronary aneurysm depends on its size[11] but is generally noted within 6 months[12]. In 6 of our 7 cases with a history of coronary involvement, coronary aneurysms had disappeared by the time of surgery. One patient with persisting coronary aneurysms was demonstrated not to have stenotic coronary lesion by CAG. The anesthetic course was uneventful even in this case.

Aspirin has been widely used as a therapeutic agent in Kawasaki disease[6]. It had been administered orally in all of our cases. Because of its anti-platelet action[13] and adverse effects on liver[14], it is preferable to discontinue aspirin before surgery. In 11 of our 19 cases, increases in serum GOT and GPT levels had been noted in the acute phase, but preoperative examination disclosed no

Table 1. Summarized characteristics of the

Case No	Sex	Age	Kinds of operation	Periods from onset to operation	Methods of anesthesia	
					Induction	Maintenance
1	M	5Y5M	hernioplasty	2Y3M	mask	N_2O, halothane
2	M	1Y9M	hernioplasty	1Y5M	mask	N_2O, halothane
3	M	11M	hernioplasty	7M	iv	N_2O
4	M	11M	orchidopexy	7M	mask	N_2O, halothane
5	M	1Y10M	orchidopexy	1Y5M	mask	N_2O, pentazocine
6	M	8Y	ganglion resection	5Y10M	iv	N_2O, pentazocine
7	F	6Y1M	hernioplasty	4Y5M	mask	N_2O, pentazocine
8	M	3Y4M	mole resection	2Y2M	mask	N_2O, halothane
9	M	2Y1M	hernioplasty	1Y4M	mask	N_2O, pentazocine
10	F	1Y9M	hernioplasty	1Y	mask	N_2O, halothane
11	F	6Y4M	appendectomy	4Y4M	iv	N_2O, halothane
12	M	4Y9M	ganglion resection	2Y10M	mask	N_2O, halothane
13	M	5Y1M	ganglion resection	3Y	mask	N_2O, halothane
14	M	2Y2M	ERCP	7M	mask	N_2O
15	M	2Y2M	Cholecystectomy	7M	mask	N_2O, pentazocine
16	M	2Y3M	hernioplasty	1Y5M	mask	N_2O
17	M	5Y11M	phymosis formation	4Y6M	mask	N_2O, pentazocine
18	F	5Y5M	hernioplasty	4Y8M	mask	N_2O, halothane
19	M	6Y2M	orchidopexy	6M	mask	N_2O, halothane

cor. an.: coronary aneurysm (dilatation of coronary artery the artery.), cor. dil.: coronary artery dilatation (dilatation of nal portion of the artery.), mask: induction of anesthesia with i.v.: induction of anesthesia by intravenous injection of sodium

liver function abnormality. Anesthesia by halothane did not cause any liver function abnormalities in our cases. However, careful consideration should be given in cases with persisting liver dysfunction when halothane is used as an anesthetic agent.

Myocarditis in the acute phase of Kawasaki disease and persisting left ventricular dysfunction[15,16] must also be taken into account before anesthesia. Our cases indicate that a period of at least 6 months from the onset of Kawasaki disease is needed to perform general anesthesia safely.

We performed 2D echocardiography in 7 cases with a history of coronary aneurysm in the acute phase of Kawasaki disease because coronary aneurysm, left ventricular function and functional derangement of cardiac valves could be evaluated easily and precisely by 2D echocardiography[17]. We consider preoperative evaluation by 2D echocardiography indispensable. However, because it is difficult to diagnose coronary artery narrowing echocardiographically, CAG is sometimes needed, as in the case with persisting coronary aneurysms in this report. Chest roentogenogram and electrocardiogram including exercise test were not essentially useful in evaluating cardiac involvement, as had been reported[17,18].

As no patient with coronary stenotic lesions was included in our study, the induction and maintenance of anesthesia were the same as those in patients without a history of Kawasaki disease. Because it is mandatory to maintain a good balance between myocardial oxygen demand and supply during anesthesia, hemodynamic and arterial blood gas monitoring during anesthesia are important. Leads II and V_5 of the electrocardiogram can be used as an indicator of myocardial ischemia[19].

patients who received general anesthesia

Acute phase complications			Preoperative complications	
Echocardiography	Hepatitis (maximum GOT/GPT)	others	Echocardiography	ECG
	+ (89/104)			
cor. an.	+* (233/109)	pericarditis	cor. an.	Q in III, aV_F
	+ (107/94)	myocarditis		
cor. an.				
	+* (67/58)			
cor. dil.	+ (26/88)			
	+* (158/153)			
	+* (130/116)			Q in II, III
cor. dil.				
cor. an.	+* (171/114)	cholecystitis		
cor. an.	+* (113/114)	cholecystitis		
cor. an.	+ (57/191)	cholecystitis pericarditis		
	+ (630/640)			

diameter more than 1.5 times that of the nornal portion of coronary artery diameter less than 1.5 times that of the nor- a gas mixture of N_2O, O_2 and halothane via a face mask., thiopental.*: hepatitis related to aspirin administration.

Conclusions: We anesthetized 19 patients with a history of Kawasaki disease more than 6 months after the onset of the disease. The anesthetic course was uneventful in all cases. Evaluation of coronary artery involvement before anesthesia and hemodynamic stabilization during anesthesia were considered important.

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