Successful Catheter Interventional Therapy for Acute Coronary Syndrome Secondary to Kawasaki Disease in Young Adults

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Acute coronary syndrome occurred in 2 young adults who had a history of Kawasaki disease (KD), but few other coronary risk factors. The first patient was a 27-year-old male with acute myocardial infarction without stenosis detected by coronary arteriography 4 years earlier. Emergency coronary arteriography showed occlusion of the right coronary artery. Aspiration-thrombectomy and rescue balloon angioplasty were successfully performed. The second patient was a 32-year-old male with unstable angina. Right coronary arteriography showed total occlusion with severe calcification. Left coronary arteriography showed 99% stenosis at the proximal site of the circumflex artery, and a directional coronary atherectomy was performed. Histological examination of a specimen from this site revealed a lipid core, macrophages, and smooth muscle cells. Restenosis was not observed on follow-up coronary arteriography after 5–6 months in either case. The coronary stenosis in each case was probably caused by accelerated atherosclerosis at the site without aneurysm as it seemed to be ‘normal’ on arteriography. Conventional catheter intervention was effective treatment. The sequelae of KD should be recognized as independent coronary risk factors. (Circ J 2003; 67: 362–365)

Key Words: Coronary risk factor; Directional coronary atherectomy; Intravascular ultrasound; Kawasaki disease

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awasaki disease (KD) was first reported in 1967! and long-term follow-up of the coronary artery lesions has revealed that a coronary aneurysm or ectasia in the early stage of KD often progresses to localized stenosis following vasculitis in the late stage? Although several studies have recommended long-term observation of patients with a history of KD3–6 others have concluded that such follow-up is innecessary if the cardiovascular complications were mild in the early stage of the disease? In childhood KD, a severe stenotic lesion is formed by regression of the coronary aneurysm in the years after the onset of the disease, and its histological findings are characterized by marked intimal thickening with multiple calcifications resulting from the arteritis. Therefore, the stiffness of the arterial wall makes the decision of the treatment strategy very difficult. For cases of older childhood KD, aortocoronary bypass surgery (CABG) is the standard therapy for severe stenosis of coronary arteries because the long-term patency of the bypass graft is satisfactory? but in young adults who have not had the coronary aneurysm detected in the early stage, the recommended therapy has not been established. We describe 2 cases of acute coronary syndrome in young adults with a history of KD.

Case Reports

Case 1

A 27-year-old man in shock was brought into Osaka Mishima Critical Care Medical Center on December 17, 2000, by ambulance after the onset of convulsions and loss of consciousness following oppressive chest sensations and vomiting. He had a history of KD from the age of 1 year and had been followed by pediatricians at our hospital. High-dose intravenous ß-globulin was not given because its benefit had not been established at that time. Since echocardiography (UCG) of his coronary artery revealed diffuse dilatation, coronary angiography (CAG) had been performed twice, at the ages of 4 and 23 (Fig 1A), to further evaluations. They demonstrated neither aneurysm nor stenosis, showing seemingly “normal” CAG. In addition, he did not have any other coronary risk factors. On admission, electrocardiography (ECG) showed ventricular tachycardia (172 beats/min), which was terminated by electrical cardioversion with a 200-J DC shock. After conversion to normal sinus rhythm, the ECG indicated ST elevation in leads II, III, and aVF, requiring urgent CAG. The right coronary artery (RCA) was completely occluded in the mid-segment (Fig 1B). Thrombi were aspirated with a percutaneous thrombectomy catheter (RESCUE™, thrombus management system, 4.5Fr 0.59 inches 135 cm, Boston Scientific), and additional inflation using a 3.0×20 mm cutting balloon (Barath balloon, Goodman, IVT) resulted in successful dilatation with 50% residual stenosis (Fig 1C). Intravascular ultrasound (IVUS, UltraCross 3.2Fr 30 MHz catheter, Boston Scientific) was performed on the 10th hospital day.
to evaluate the lesion. The residual stenosis in the mid-
segment of the RCA was of the same degree as seen on the
previous CAG, and the IVUS images revealed severe calci-
fication and a thrombus-like low echo at the site (Fig 1D,E).
Because his coronary arteries were diffusely dilated and the
minimum lumen diameters measured on IVUS images
were sufficiently large, angioplasty was not required. Left
ventriculography (LVG) showed akinesis within a narrow
limit of the inferior wall. He was given continuous warfarin
potassium as anticoagulant therapy and when he was tested
after 1, 3 and 6 months, treadmill exercise testing demon-
strated a negative response. Follow-up CAG performed on
April 20, 2001 showed no restenosis at the lesion.

Case 2
A 32-year-old man with a recent history of unstable
angina was urgently admitted in January 2001. He had a
history of KD from the age of 2 years and had been
followed up at a local hospital for 11 years. According to
him and his mother, UCG might have been performed 2 or
3 times, but not CAG. They could not remember the UCG
findings and we could not confirm them because his
medical records had been discarded. His only coronary risk
factor was smoking. On admission, the ECG showed
horizontal ST depression in leads II, III, aVf and V2-6. After
intravenous administration of isosorbide dinitrate and
heparin sodium, the chest oppression disappeared com-
pletely and the ST depression on the ECG was diminished.
Left coronary angiography showed 99% stenosis at the proximal site of the circumflex artery (LCx) with diffuse
dilatation of other sites (Fig 2A). IVUS images at the steno-
sis site revealed intimal thickening with a heterogeneous
echo (Fig 2C) and images of the left anterior descending
artery demonstrated calcification located on the surface of
the intima (Fig 2E). In addition, extensive aneurysmal
calcification was observed around the middle portion of the
RCA on fluoroscopy (Fig 2G). Although the RCA was
completely occluded but sufficient bridging collateral flow was con-
firmed. (G) Diffuse and partially giant aneurysmal cal-
cification (arrowheads) at the mid-portion of the RCA.

Fig 1. Case 1. Right coronary arteriography left anterior
oblique 50° (A) 4 years earlier, showing a diffusely en-
larged lumen without segmental stenosis. (B) At urgent
CAG. (C) After catheter intervention. Dilatation was suc-
cessful within a residual stenosis of 50%. (D, E) IVUS
images at the time of the follow-up CAG reveal calcifica-
tion and a thrombus-like weak echo (arrow heads). The
minimum lumen diameter was sufficiently large.

Fig 2. Case 2. (A) Left coronary arteriography right an-
terior oblique 30° and caudal 25° showing 99% stenosis
at the proximal site of the LCx. (B) Dilatation was suc-
cessful for the stenosis after DCA and a cutting balloon.
(C) An IVUS image at the stenosis, which was at the bifurcation of the LAD in the LCx, exhibiting a heteroge-
eous echo, which indicated athrosclerotic plaque. (D) After catheter intervention, an IVUS image revealed
successful dilatation of the lumen. (E) Calcification with
acoustic shadow was detected at the LAD, which was
angiographically normal. (F) The RCA was completely
occluded but sufficient bridging collateral flow was con-
firmed. (G) Diffuse and partially giant aneurysmal cal-
cification (arrowheads) at the mid-portion of the RCA.
patients with KD are slowly progressive over a long period, although it is well known the coronary lesions of changed morphologically at the lesion site during this which suggests that his coronary artery might not have myocardial infarction. UCG had been performed each year, nor stenotic lesions had been detected by CAG performed on July 11, 2001 showed no restenosis exercise testing demonstrated a negative response. Follow-up CAG performed on July 11, 2001 showed no restenosis at the lesion and LVG showed normal wall motion.

Discussion

Progressive localized stenosis at the site of a regressed aneurysm is often observed in the late stage of KD. Even an angiographically normal coronary artery may develop intimal thickening, leading to premature atherosclerosis. It has also been reported that endothelial dysfunction persists for a long period in patients with KD. The endothelium is important in controlling vascular tone and protecting the vessel against atherosclerosis via the release of relaxing factors, such as nitric oxide, which inhibits platelet adherence and smooth muscle proliferation. Therefore, patients with KD have the potential to develop premature atherosclerosis without a history of dilated coronary arteries and so a history of KD may be an independent coronary risk factor in young adults.

We reported KD with acute coronary syndrome in 2 young adults. IVUS images of their coronary artery walls showed diffuse ectasia and severe calcification. Because it is rare for atherosclerosis to be observed in young adults with few risk factors, it would appear that these findings are sequelae of KD. Interestingly, neither aneurysms nor stenotic lesions had been detected by CAG performed at the ages of 4 and 23 years in patient 1 who had the acute myocardial infarction. UCG had been performed each year, which suggests that his coronary artery might not have changed morphologically at the lesion site during this period, although it is well known the coronary lesions of patients with KD are slowly progressive over a long period of time. Taken together, the coronary lesion in case 1 was formed by accelerated atherosclerosis caused by endothelial dysfunction occurring within the past 4 years. Previous clinical studies have suggested that is not an association between the degree of stenosis and coronary events caused by the formation of occluding thrombi resulting from plaque rupture or fissuring. We speculate that the RCA contained vulnerable plaque without luminal narrowing, and subsequent plaque rupture resulted in AMI. If IVUS had been performed 4 years earlier, some useful information would have been obtained, such as soft plaques, to say nothing of the calcifications. Therefore, more careful attention must be paid to his clinical course and long-term follow-up, including IVUS, is very important.

Patient 2 had been visiting a local hospital under the diagnosis of KD since the age of 2 years, but was told at 13 years of age that further follow-up was not necessary. His RCA as revealed by CAG was similar in appearance to ‘segmental stenosis’, as described by the Kawasaki Disease Research Committee of the Japanese Ministry of Health and Welfare, and acted as a bridging vessel, as reported by Suzuki et al. Because collateral flow to the distal portion was sufficient and his episode of angina was very recent, the RCA was not thought to be the culprit lesion. In the middle portion of the RCA lesion, there were severe calcifications resembling an eggshell, so there may have been a giant coronary aneurysm present in the early stage of KD, which resulted in a thrombosed aneurysm. At the time he was diagnosed with KD, there had not been any reports of the cardiovascular complications of KD, and echocardiography had not yet come into widespread use. Thus, an early aneurysm would not have been detected, but such cases will become more prevalent hereafter.

On the other hand, IVUS images at the site of the LCx revealed soft plaque without calcification. The characteristic histological findings in KD patients are multiple calcifications in the arterial wall and intimal-medial thickening, not only at the coronary lesions but also in angiographically normal arteries. In addition, patient 2 had an obvious episode of effort angina, whereas most patients with KD rarely have symptoms of ischemia. Thus, we speculate that the proximal lesion of the LCx, which was thought to be the culprit lesion, resulted from atherosclerosis following subsequent endothelial dysfunction rather than from vasculitis or a thrombosed aneurysm. Indeed, DCA samples of the culprit lesion contained cholesterol crystals, many macrophages, newly organized thrombi, and a small number of smooth muscle cells that were α-actin-positive and SM-2-negative, indicating a de-differentiated phenotype. These are just vulnerable plaque themselves and are classified as advanced type, type V or VI, of atherosclerotic lesions and differ markedly from the coronary aneurysms or regressed aneurysms observed in children with KD.

In young children with KD, the long-term results of CABG are unsatisfactory mainly because of the small caliber of the autosaphenous vein grafts. Therefore, percutaneous transluminal coronary angioplasty (PTCA) is now performed to enable CABG to be postponed until the patients have vessels of sufficient size. In patient 2, although the vessel size was sufficiently large, the culprit lesion was in the LCx, which was not suitable for an internal mammary artery graft and the long-term patency of saphenous vein grafts (SVG) is not satisfactory. In CAGB using SVG was performed, graft failure occurs at a rate of...
30–50% and repeat CABG is very difficult. However, the success rate of PCI to the native LCx is very low, too, because total occlusion will occur just proximal to the affected portion of LCx. We had discussed these issues with patient 2 and his parents in detail, after which he decided to undergo PCI, with subsequent CABG if the procedure proved unsuccessful. As his coronary artery was dilated at the proximal and distal sites of the lesion, we performed DCA but did not use a rotablator. There were no complications attributable to this procedure and the follow-up CAG revealed no restenosis.

In conclusion, PCI using IVUS may be effective in young adults with acute coronary syndrome secondary to KD, as well as in adults with the usual atherosclerotic plaque. The reason PCI succeeded might be that in these cases the coronary lesions were formed by accelerated atherosclerosis from endothelial dysfunction, rather than the regressed aneurysms that were common in patients with childhood KD. A history of KD may be an independent coronary risk factor and so long-term follow-up, including CAG and IVUS, is important. The sequelae of KD should be considered in young adults who have coronary artery disease without any risk factors.

References