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Case Report

Coronary Artery Bypass Grafting in a Child with Kawasaki Disease

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Abstract

Kawasaki disease with cardiac involvement can result in the development of coronary artery aneurysm, stenosis, or thrombosis posing significant cardiovascular risks if left untreated. A two-year-old child with a history of Kawasaki disease presented with easy fatiguability, dyspnea, and pedal edema. Echocardiography revealed severe global hypokinesia of the left ventricle with an ejection fraction of 25%. Computed tomography (CT) coronary angiogram showed significant stenosis and ectasia of both the left anterior descending artery and the right coronary artery, with intramural thrombi. The child underwent successful double vessel coronary artery bypass grafting using bilateral internal mammary artery under cardiopulmonary bypass. Postoperative recovery was uneventful, with an improved ejection fraction of 35–40%. At the 3-month follow-up, the patient remained asymptomatic with patent grafts on repeat CT angiography.

Keywords: kawasaki disease; coronary artery aneurysm; coronary artery disease; pediatric cabg

Introduction

Kawasaki disease, first described by Tomisaku Kawasaki in 1967, occurs worldwide in both endemic and communitywide epidemic areas of America, Europe, and Asia and in children of all races.[1] Kawasaki disease is an acute vasculitis of unknown etiology, predominantly affecting male children under 5 years of age. It is characterized by fever, rash, bilateral conjunctivitis, erythema of the lips and oral mucosa (strawberry tongue), and cervical lymphadenopathy. The epidemic occurrence and self-limiting nature of the disease suggest an infectious cause; however, a specific infectious agent has yet to be identified. The disease has an overall mortality rate of 0.17%, with all deaths attributed to coronary artery disease (CAD) and its sequaele.[2] Kawasaki disease is a generalized systemic vasculitis that affects small- to medium-sized arteries, with a strong predilection for the coronary arteries. The development of arteritis is caused by inflammatory infiltration, myointimal proliferation, destruction of the media, and dilation of the vessel. Destruction of the vessel, coupled with fibroblast proliferation, leads to remodeling, intimal thickening, and thrombus formation/ embolic phenomenon over a period of time.

The most severe cardiovascular sequel of Kawasaki disease is coronary artery aneurysm (CAA) or ectasia. CAA can vary in size and shape (fusiform, saccular, or ectatic). Giant CAAs (internal diameter >8 mm or a Z score ≥10) have the highest risk of morbidity and mortality. Up to 33% of such aneurysms contain thrombi that can become occlusive and are associated with thromboembolic events, myocardial infarction, arrhythmias, heart failure, and sudden death.[3] Kawasaki disease can result in increased serum viscosity, leading to reduced arterial and capillary blood flow, and subsequently thrombosis and embolic complications.

While medical management with high-dose aspirin and intravenous immunoglobulin (IVIG) is effective in the acute phase, revascularization procedures such as CABG become necessary in cases of advanced CAD. We report a rare case of successful CABG in a two-year-old with severe coronary complications from Kawasaki disease.

Case Report

Legends for Figures

A two-year-old child with Kawasaki disease presented to our institution with chief complaints of fatigue, dyspnea, and pedal edema. There was no family history of such illness in the siblings, and past medical records were unavailable. The electrocardiogram showed q-waves and T-wave inversion in leads I, II, and aVL along with T-wave inversion in leads V2-V6 **(Figure 1).**

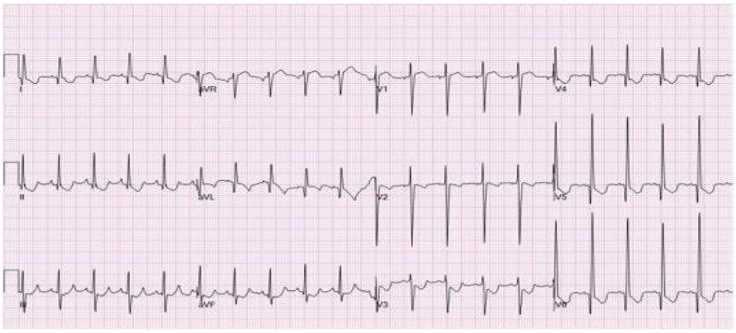

Figure 1: 12-lead electrocardiogram showing q waves and T-wave inversion in leads I, II, and aVL; and T-wave inversion in leads V2-V6

Echocardiography showed severe left ventricular systolic dysfunction with an ejection fraction of 25%, mild mitral regurgitation, and no other abnormality. Computed tomographic (CT) coronary angiography revealed ectatic and aneurysmal left main coronary artery, left anterior descending artery (LAD) and right coronary artery (RCA) with thrombi within their lumens **(Figure 2, 3).**

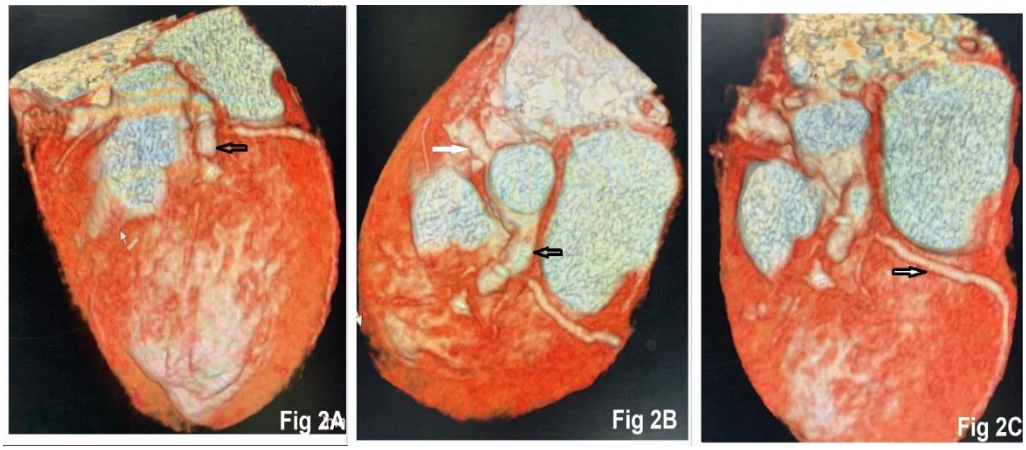

Figure 2: Computed tomographic coronary angiography depicting ectatic left main coronary artery and left anterior descending artery (black arrows, Figure 2A, 2B), ectatic right coronary artery (white arrow, Figure 2B), and normal left circumflex artery (arrow, Figure 2C)

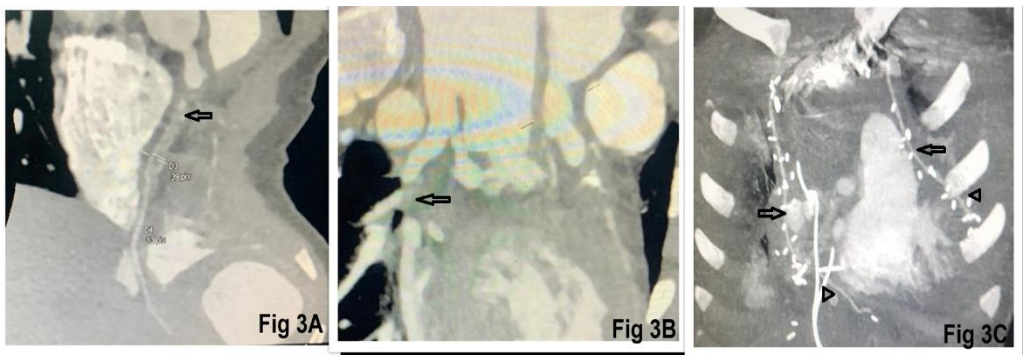

Figure 3: Computed tomographic coronary angiography showing intramural thrombus in left anterior descending artery (Figure 3A, 3B). Fig 3C shows patent left and right internal mammary artery grafts to the left anterior descending artery and right coronary artery respectively (arrows) with the good distal flow (arrow heads)

The surgical option of myocardial revascularization (i.e. CABG) was offered and informed consent was obtained from the parents. Intraoperative monitoring consisted of a 4-lead ECG (lead II, III, V5, and mid-clavicular) with ST segment analysis, invasive arterial pressure, central venous pressure, nasopharyngeal temperature, and urine output. The child underwent double-vessel CABG surgery under cardiopulmonary bypass. The skeletonized left and right internal mammary arteries (IMA) were anastomosed using 8-0 polypropylene suture to the LAD and RCA respectively. The postoperative course was uneventful and the left ventricular ejection fraction improved to 35-40%. Medical therapy was continued with dual antiplatelet therapy, statin, and diuretics, among other medications. At the 3-month follow-up, the child was asymptomatic, and repeat CT angiography showed patent LAD and RCA grafts with satisfactory distal flow (Figure 3C).

Discussion

Kawasaki disease and its coronary complications have been proven to cause ischemic heart disease in children. It is now the most common cause of acquired CAD in children. Although serious coronary complications occur in only 2–3% of cases, these can be life-threatening, with a 22% mortality rate at first myocardial infarction.[4] In the acute phase of the disease, high-dose aspirin 80-100 mg/kg/d, along with intravenous

immunoglobulin 2 g/kg, work synergistically to provide an anti-inflammatory effect. Development of surgical treatment for the CAD is essential in preventing premature death and improves the quality of life of children.[4] To treat myocardial ischemia in children, Kitamura et al. first performed CABG in a pediatric patient using an autologous saphenous vein.[5] In the early 1980s, they began to use the IMA as a bypass graft to the LAD artery, which later was proven to improve long-term life expectancy with its favorable long-term patency, as well as growth potential. Thus, the excellent characteristics of the IMA have come to be widely known among pediatric cardiac surgeons, and a growing number of CABG surgery procedures using the IMA are now being performed worldwide.[6] Pediatric CABG surgery using the pedicled IMA, either single or bilateral, can be safe not only for patients with Kawasaki coronary disease but also for infants with congenital coronary lesions. There is valid evidence for the IMA graft being a viable structure, accommodating in length and diameter for the growth of children. Long-term follow-up results up to 20 years and prognosis are favorable and postoperative quality of life is markedly improved.[4]

Two-dimensional echocardiography with a high-frequency transducer has been used for the evaluation of coronary arteries and the diagnosis of CAD in patients with Kawasaki disease. However, the sensitivity and specificity of echocardiography for identifying coronary artery abnormalities are unclear. It is reasonable to use advanced imaging studies such as CT angiography, cardiac magnetic resonance imaging, or invasive angiography on patients with severe proximal coronary artery abnormalities.[7] Invasive coronary angiography is considered to be the gold standard for diagnosis of CAD, follow-up of CAA, thrombosis, and stenosis in patients with Kawasaki Disease. However, the availability of multi-detector CT coronary angiography provides a viable alternative as a non-invasive imaging modality for sequential follow-up of patients with Kawasaki disease.[8] High-quality multidetector CT angiography images of coronary arterial anatomy can be obtained after adequate heart rate control using beta blockers.

The anesthetic concerns addressing Kawasaki disease are limited to single case reports or case-series. The important anesthetic issues in these children have been the cardiac manifestations such as CAAs, pericardial effusion, arrhythmias, and myocardial infarction. Clinicians are encouraged to consider a Kawasaki disease diagnosis in patients with prolonged fever and rash and should evaluate the potential for myocardial compromise if the patient experiences rapid deterioration perioperatively. A preoperative assessment should consist of 12-lead electrocardiography, echocardiography, and CT coronary angiography to detect any cardiac abnormalities.[3] Perioperative management should involve standard American Society of Anesthesiologists monitoring, including invasive arterial pressure monitoring, central venous pressure monitoring, and transesophageal echocardiography. In patients at risk for ischemic events, it is recommended to display the maximum number of ECG leads during the perioperative period to enhance continuous and comprehensive assessment of ST segment and T-wave changes. [9,10]

In conclusion, the case underscores the importance of early recognition and timely intervention in children with Kawasaki disease and coronary involvement. CABG using IMA grafts is a viable and safe option even in very young patients, with excellent early outcomes and potential for long-term success. Continued follow-up with multimodal imaging and optimal medical therapy is essential for these patients.

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