



# Kawasaki disease: case report of a diagnostic dilemma and often a missed diagnosis

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## Background

Management of cardiovascular sequelae to Kawasaki disease (KD) is challenging to adult cardiologists. Vasculitis of medium-sized arteries especially coronary arteries often leads to focal intimal thickening and aneurysmal dilatation of one or more coronary arteries. It needs special attention to recognize coronary artery involvement because of potential long-term morbidity and mortality. We present a case of diagnostic dilemma in young adult Chinese male with KD.

## Case summary

This asymptomatic patient was found to have deep Q waves in anterior leads on screening electrocardiography and was thought to have myocarditis after depiction of wall motion abnormality on echocardiography, later to be confirmed to have left anterior descending artery (LAD) territory infarct on cardiac magnetic resonance imaging. Coronary computed tomography angiogram depicted proximal LAD aneurysm with calcified plaque/thrombus. Additionally, there was an 18 mm giant right coronary artery (RCA) aneurysm with braid-like appearance and soft plaque (mural thrombus). His previous medical history included fever and cervical lymphadenopathy. Because of the high risk he was commenced on long-term low-dose aspirin and  $\beta$ -adrenergic-blocking agent to reduce myocardial oxygen consumption; however, 3 years later, he presented to the emergency department with acute inferior myocardial infarction. He was noted to have total occlusion of the proximal RCA and was treated aggressively with thrombectomy and percutaneous balloon angioplasty followed by medical management with  $\beta$ -blockers, sacubitril/valsartan, clopidogrel, and rivaroxaban without subsequent adverse cardiovascular events.

## Discussion

Kawasaki disease is one of the main causes of coronary artery disease in young adults and can be easily overlooked.

## Keywords

Case report • Kawasaki disease • Adult • Coronary artery aneurysm • Coronary artery disease • Plaque • Thrombus

## Learning points

- Kawasaki disease is one of the main causes of coronary artery diseases in young adults.
- An up-to-date knowledge of the disease, low threshold to suspect its diagnosis and prompt management can prevent its life-threatening complications.

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## Introduction

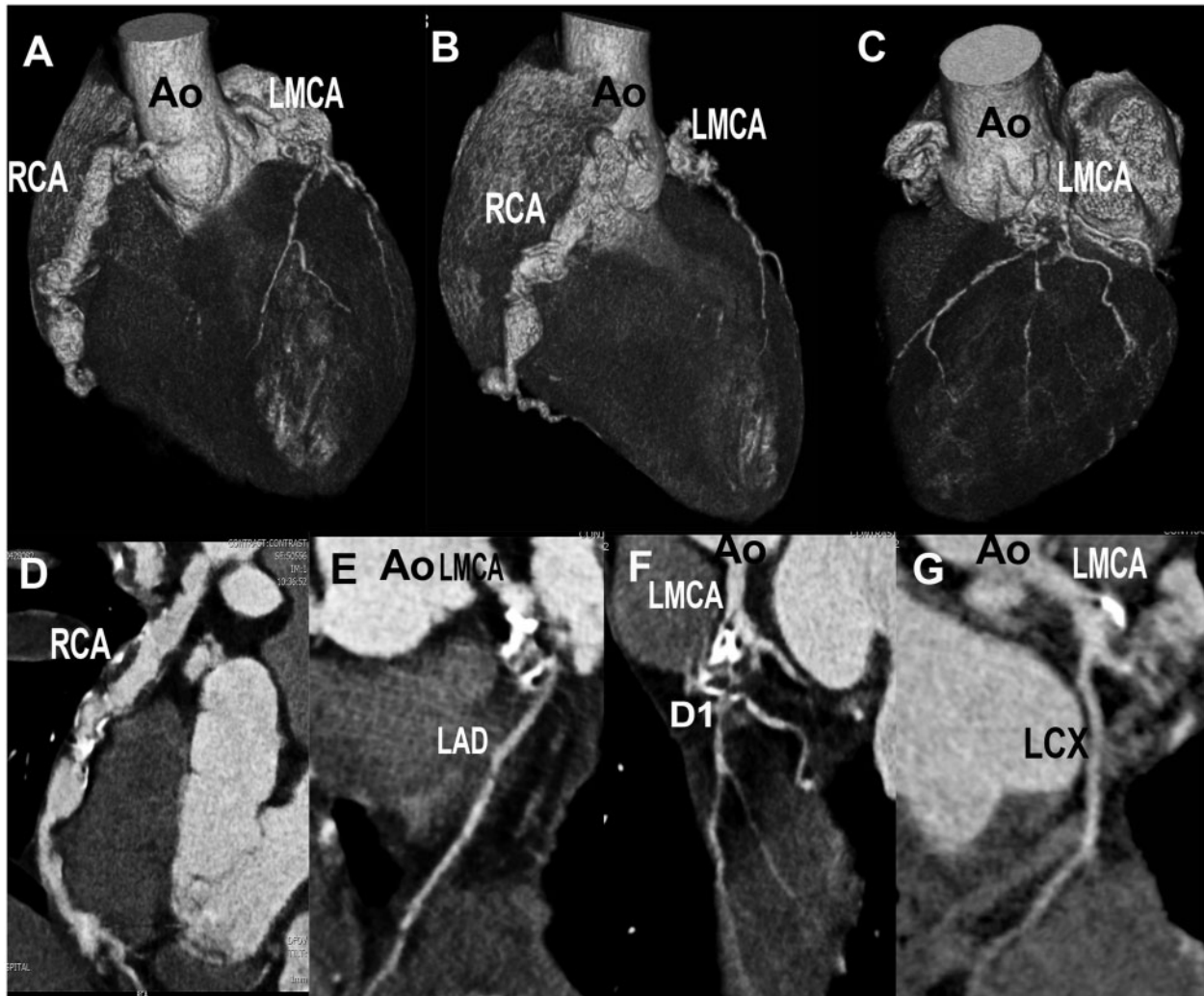
Kawasaki disease (KD), a disease of infants and toddlers (age range 6 months–5 years), is an acute self-limiting inflammatory condition involving medium-sized vessels including coronary arteries leading to intimal damage, stenosis, and aneurysmal dilatation. Diagnostic criteria include fever for 5 days or more, lips and oral mucosal changes, bilateral non-purulent conjunctival congestion, polymorphous exanthema along the trunk, changes of the peripheral extremities and subsequent desquamation of fingertips, and non-purulent cervical lymphadenopathy of more than 1.5 cm in size.<sup>1</sup> Most of the KD patients recover fully with steroid and intravenous immunoglobulin; however, it needs special attention to recognize coronary artery involvement because of potential long-term morbidity and mortality. It is one of the main causes of coronary artery disease (CAD) in young adult population.<sup>2</sup> However, rarely first presentation could be in an adult patient.<sup>3</sup> Therefore, it means something different to a paediatrician than it does to an internist, and it is easy to be overlooked. We present a young male adult with KD who was first missed and then misdiagnosed. This case highlights the role of multimodality imaging in the diagnosis of this challenging condition.

## Timeline

## Case presentation

Three years ago, an 18-year-old asymptomatic Chinese university basketball player was found to have abnormal Q wave in V1–V4 during a routine screening electrocardiography (ECG). He had no significant medical history except for a neglected month-long self-limiting fever and cervical lymphadenopathy at 7 years of age which was not diagnosed to be KD at that time. His physical examination was unremarkable (temperature 37.6°C, pulse 83 b.p.m., respiratory rate 17/min, and blood pressure 125/73 mmHg); Echocardiography showed anterior and anteroseptal wall motion abnormality, and he had negative troponins (Trop I—15 ng/L, normal range 10–23 ng/L) and normal inflammatory markers. Initially, he was considered to have myocarditis based on his age and no family history of sudden cardiac death, valvular heart disease, or CAD. However, dynamic ST elevation (V2–V3) along with T wave inversion (V1–V3) on 24-h Holter monitoring ECG and persistent anterior Q wave on 12 leads ECG raised the suspicion of CAD prompting cardiac magnetic resonance imaging (CMR) with gadolinium contrast which showed ~60% delayed subendocardial hyperenhancement in the basal to mid-anterior/anteroseptal segments and adjacent papillary muscle confirming left anterior descending artery (LAD) territory infarct with mild left ventricular systolic dysfunction (LVSD) [ejection fraction (EF): 45%] (Supplementary material online, Video S1). To further

	Presentation	Investigations	Findings	Management
11 years prior to current admission 2008	Fever		Cervical lymphadenopathy	Symptomatic
3 years prior to current admission 2015	Incidental Finding	Electrocardiography (ECG)	Abnormal Q wave in V1–V4	Advised to stop high-intensity exercise
		Echocardiography	Anteroseptal wall motion abnormality	Low-dose aspirin and $\beta$ -blocker
		Cardiac magnetic resonance imaging	Left anterior descending artery (LAD) territory infarct with mild left ventricular systolic dysfunction (LVSD)	
		Coronary computed tomography angiography	Aneurysmal dilatation of proximal LAD with calcified plaque Giant right coronary artery (RCA) aneurysm 18 mm	
Current presentation 2019	Chest tightness for 4 h, dizziness, fatigue, and sweating	ECG	5–9 mm ST elevation and hyperacute T wave in inferior leads	Thrombectomy Percutaneous balloon angioplasty
		Percutaneous coronary intervention	Occluded proximal LAD and distal supply through its own bridging vessels Complete occlusion of culprit RCA	$\beta$ -Blockers, sacubitril/valsartan, clopidogrel and rivaroxaban
		Echocardiography	Severe LVSD (ejection fraction 33%)	

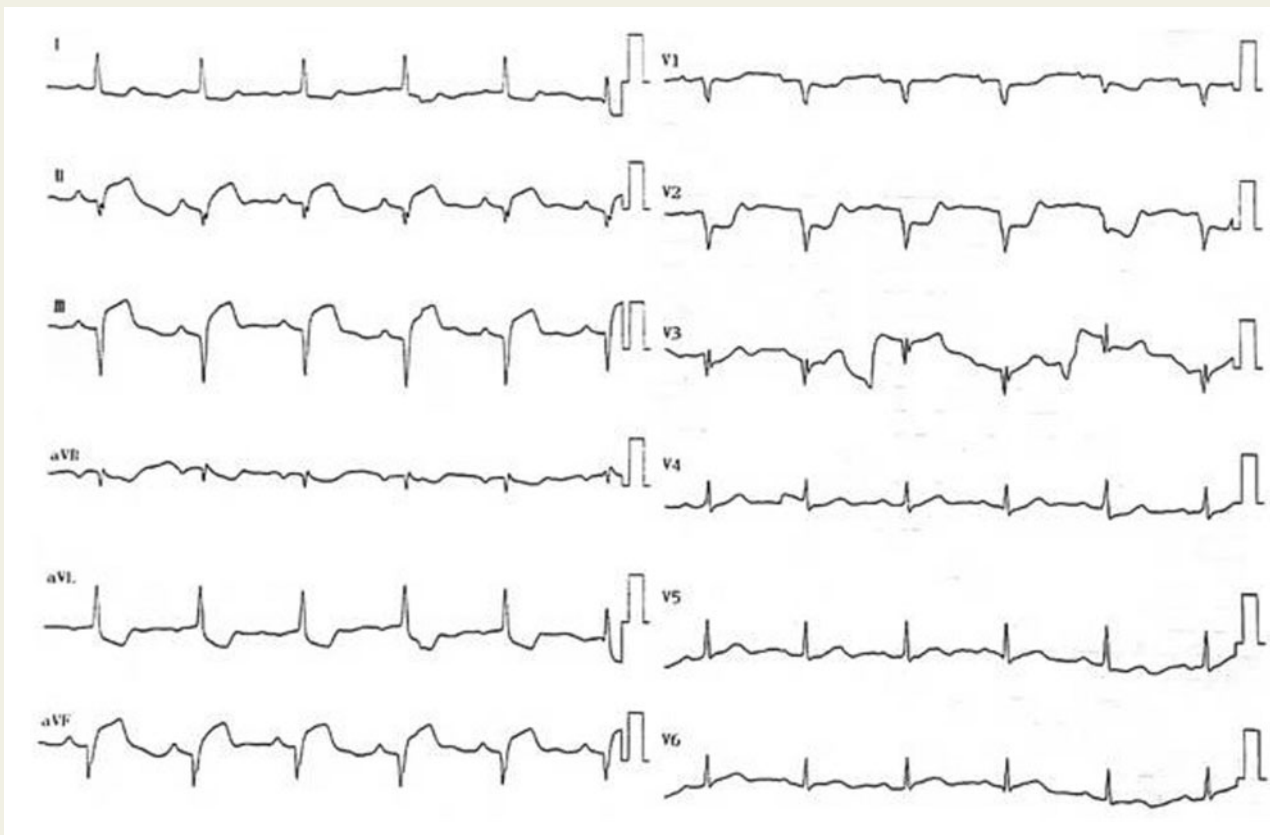


**Figure 1** Coronary computed tomography angiography image shows right coronary artery aneurysm with calcified plaque (A, B, and D) and calcified plaque in proximal left anterior descending artery (C, E, and F). Ao, aorta; LAD, left anterior descending artery; LCX, left circumflex coronary artery; LMCA, left mainstem coronary artery; RCA, right coronary artery.

investigate this, coronary computed tomography (CT) angiography was performed that showed aneurysmal dilation of the proximal LAD with calcified plaque; and braid-like appearance of a giant aneurysm measuring 18 mm and mural plaque in the right coronary artery (RCA) (Figure 1). The patient was advised to stop high-intensity exercise activities due to high risk and was started on long-term low-dose aspirin and  $\beta$ -adrenergic-blocking drug to reduce myocardial oxygen consumption. Patient refused warfarin, further coronary angiography examination, and any surgical or transcatheter intervention.

During current admission, he was brought in by ambulance after 4 h of chest tightness worsening on exertion, dizziness, fatigue, and sweating. His ECG (Figure 2) showed a 5–9 mm ST-segment elevation and hyperacute T waves in inferior and lateral leads (II, III, aVF, V4, V5, and V6) and a 2–6 mm ST-segment depression in anterior chest leads (V1, V2, and V3). Primary percutaneous coronary angiography revealed occluded proximal LAD (Supplementary material online,

Video S2) and distal supply through its own bridging branches (jellyfish head like) with Thrombolysis in Myocardial Infarction (TIMI) flow grade 0–1; 50–90% segmental stenosis in OM1 branch; and 100% occlusion in the proximal part of RCA (culprit artery) with TIMI flow grade 0. The culprit RCA artery occlusion was expanded thrice (12 atms  $\times$  10 s) with 2.5 mm  $\times$  15 mm balloon followed by thrombectomy (Supplementary material online, Video S3) and thrombus aspiration under 8000 u heparin infusion and 20 mg urokinase for residual thrombi that resulted in full flow recovery. The patient developed ventricular fibrillation intra-operatively requiring cardioversion. Post-operatively, he was given tirofiban for 24 h and low molecular weight heparin for 7 days. As patient refused further surgical intervention and oral warfarin, dual-antiplatelet and rivaroxaban were prescribed for 3 months followed by long-term clopidogrel and rivaroxaban. For severe LVSD (EF 33% on echocardiography; Supplementary material online, Video S4), he is being treated conservatively with  $\beta$ -blockers



**Figure 2** Electrocardiography depicting recent inferior infarct and chronic left anterior descending artery territory changes.

and sacubitril/valsartan without subsequent adverse cardiovascular events. His LV function has improved with EF of 42% on follow-up.

## Discussion

Kawasaki disease, first reported in 1967 from Japan, is an acute, self-limited vasculitis of unknown aetiology. Many aspects of aetiology of KD have been the subject of debate and extensive research and include autoimmune, genetic factors and viral or bacterial infections.<sup>4</sup> About a quarter of patients develop coronary artery complications without active treatment.<sup>5</sup> In those patients, destruction of the internal elastic lamina, intense inflammatory cells infiltrate, and smooth muscle cell death manifests as coronary artery aneurysm in 6–8 weeks of the acute episode. Aneurysms primarily regress through myo-intimal proliferation, even though the arterial structure and function remain abnormal and there is always an important ongoing risk of stenosis and occlusion of these vessels. In ~0.5–1% of KD patients a giant aneurysm (more than 8 mm diameter) can develop, leading to coronary stenosis, obstruction, or acute thrombosis. There is increased incidence of myocardial infarction (MI), ischaemic heart disease, and sudden cardiac death in such cases. Myocardial infarction is a poor prognostic factor with mortality after first MI at 22% and 70–80% in subsequent events.<sup>5</sup>

Echocardiography is a non-invasive technique that has a high sensitivity and specificity for the detection of abnormalities of the proximal coronary arteries and is considered to be the ideal imaging modality for cardiac assessment. It is recommended that two-dimensional echocardiography evaluation should focus on imaging of coronary arteries as far as possible with especial focus on the left main stem, LAD, left circumflex coronary artery, RCA, and posterior descending arteries in patients with suspected KD.<sup>6</sup> Nevertheless, the visualization of coronary arteries becomes progressively more difficult as a child grows and body size increases. It is not always easy to identify thus leading to a missed diagnosis quite often, such as in our case.

Myocardial involvement with LV dysfunction is present in 20% of patients at diagnosis. Historically, myocardial inflammation has been documented in 50–70% of patients using planar or single-photon emission CT and <sup>99m</sup>Tc-labelled white blood cell scans. However, CMR scanning has largely replaced these modalities due to its ability to depict WMA, late gadolinium enhancement, oedema, and strain pattern to differentiate between myocarditis and CAD.<sup>7</sup>

According to the risk stratification,<sup>8</sup> the patient belonged to risk level V (coronary artery obstruction). In those patients, cardiac catheterization with selective coronary angiography should be performed. Catheter interventions, such as balloon angioplasty, stent placement, or rotational ablation have been performed in a relatively small number of children with KD in Japan. Balloon angioplasty has not been successful because of calcification or dense

fibrosis in the arterial wall and catheter intervention is contraindicated for multiple and long-segment lesions. As an alternative procedure, bypass surgery, stent placement, or rotational ablation is advisable.<sup>4,8,9</sup> Regrettably, the patient refused further surgical intervention. Because of high risk (giant coronary artery aneurysm, MI, and myocardial ischaemia) dual-antiplatelet and rivaroxaban were advised based on ESC guidelines 2018 for the first 3 months though patient opted not to take warfarin, followed by long-term clopidogrel and rivaroxaban along with  $\beta$ -adrenergic-blocking drug and sacubitril/valsartan for symptomatic relief and prevention of morbidity and mortality. Patient had no subsequent cardiovascular complications till present.

## Conclusion

Kawasaki disease is one of the main causes of CADs in young adults that cannot infrequently be missed. An up-to-date knowledge of the disease and its consequences can minimize both delayed and missed diagnosis and aid timely management to prevent its life-threatening complications.

## Lead author biography



Dr Zaib Bin Jawaid is currently a clinical resident of cardiology and is working in Echo-cardiology lab in Qilu Hospital affiliated to Shandong University. He is a young researcher who developed his interest in science and research from his high school age, frequently attending school science camps. He is a very keen learner. He received his basic medical degree in year 2017 from Cheeloo College of Medicine, Shandong University and will complete his Master's degree in internal medicine (Cardiology) from his alma mater this summer.

## Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

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**Slide sets:** A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

**Consent:** The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

**Conflict of interest:** none declared.

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