Case Report

Computed Tomography Angiography Indications in the Follow-Up of Kawasaki Disease Patients

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Abstract

Kawasaki disease (KD), or mucocutaneous lymph node syndrome, is a vasculitis that primarily affects young children and results in coronary artery abnormalities. Echocardiography is the standard imaging modality for monitoring KD patients; however, this method does not detect some coronary artery anomalies. This case report demonstrates the significance of computed tomography (CT) angiography in identifying previously undiagnosed coronary abnormalities in a KD patient.

We herein describe a 7-year-old male who presented with symptoms consistent with KD and was treated subsequently with intravenous immune globulin (IVIG). Follow-up echocardiography showed no significant coronary artery abnormalities. Three years later, the patient presented with flu-like symptoms, and an ECG revealed anterolateral ischemic changes. Echocardiography showed normal coronary arteries. Nonetheless, a CT angiogram was performed due to the ischemic changes on ECG, and it identified a myocardial bridge in the left anterior descending artery, which had not been detected by echocardiography or ECG.

This case report emphasizes the importance of considering CT angiography as an adjunct imaging modality in the evaluation and follow-up of KD patients, particularly when echocardiographic findings are inconclusive or when clinical presentation raises concerns for potential coronary artery abnormalities. Further research is needed to establish evidence-based guidelines for the optimal timing and clinical indications for CT angiography in KD patients.

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Introduction

Kawasaki disease (KD) is a systemic vasculitis of unknown etiology that predominantly affects children under the age of five.[1-3] It is characterized by acute onset of fever, rash, mucosal changes, and lymphadenopathy, with the most severe potential complications leading to coronary artery aneurysms. Although the exact cause of KD remains

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unknown, timely diagnosis and appropriate treatment with intravenous immunoglobulin (IVIG) and aspirin reduce the risk of coronary artery complications significantly.[4,5]

Echocardiography is the primary imaging modality for monitoring the progression of coronary artery involvement in KD patients.[6] Nonetheless, its limitations in visualizing terminal aneurysms and myocardial bridge changes highlight the need for supplementary imaging techniques such as computed tomography (CT) angiography. CT angiography allows for a more comprehensive assessment of coronary artery anatomy, including the identification of ectasia, aneurysms, and myocardial bridging, which may not be evident in echocardiography.[7]

The rationale for this case report is to investigate the optimal timing and indications for CT angiography in the follow-up of KD.

It is noteworthy that the patient's muscle bridge was an incidental or congenital finding and not a consequence of KD. Studies have proposed a 5-year interval for CT angiography, but there is limited consensus on the appropriate time frame and clinical conditions that warrant its use. Through the examination of a male patient diagnosed with KD, this report seeks to shed light on the potential benefits and limitations of CT angiography in the management of these patients and contribute to the development of evidence-based guidelines for its application.

Case Report

A male patient, aged 7 years and 3 months, weighing 45 kg and measuring 139 cm in height, presented in January 2019 with symptoms of fever, runny nose, and sore throat. He was initially diagnosed with an upper respiratory tract infection and treated with a pediatric gripe and azithromycin syrup. During his course of azithromycin, he developed generalized erythema, which resolved within 2 days. Ten days later, he experienced exfoliation of the extremities and neck lymphadenopathy, prompting a referral to a cardiologist for a suspected KD diagnosis. Upon examination by a pediatric heart fellow, the patient's heart auscultation was found to be normal. Echocardiography results showed the following coronary vessel sizes: right coronary artery (RCA) of 3.07 mm, left coronary artery (LCA) of 0.11 mm, left anterior descending artery (LAD) of 2.37 mm, left circumflex artery (LCX) of 2.24 mm, and ejection fraction (EF) of 65%. Consequently, the patient was admitted to the hospital and administered 2 g/kg of IVIG as a standard treatment for KD.

The patient was discharged with a prescription for aspirin and returned for a follow-up 15 days after discharge. During the heart examination, the patient's heart auscultation was found to be normal, with no murmurs or extra sounds detected. The echocardiography report 15 days post-discharge indicated no change in the size of the coronary arteries. He adhered to the prescribed aspirin regimen and attended scheduled follow-up appointments. One year later, the patient returned for echocardiography and a follow-up consultation to further monitor his condition. At the 1-year follow-up, the patient weighed 49 kg, stood 149 cm tall, and had blood pressure readings of 100 mm Hg systolic and 60 mm Hg diastolic. Echocardiography results showed a decrease in the size of the coronary arteries, with measurements as follows: RCA 3.07 mm, LCA 3.11 mm, LAD 2.8 mm, LCX 2.3 mm, and distal LAD 1.9 mm. Given the normalization of coronary artery sizes and platelet counts, the patient's aspirin regimen was discontinued, and he was subsequently discharged from care.

In November 2022, the patient, then 11 years old, weighing 63 kg, and measuring 168 cm in height, presented with flu-like symptoms and was referred to the pediatric heart fellow who had been managing his previous follow-

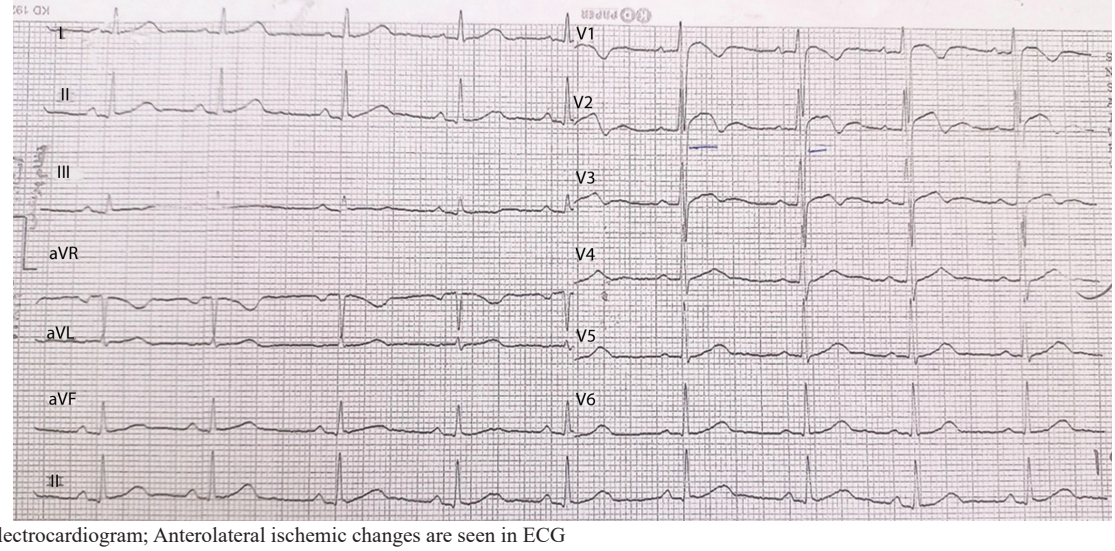


Figure 1. Electrocardiogram; Anterolateral ischemic changes are seen in ECG

ups. During the examination, the patient did not exhibit any cardiac symptoms or chest pain. Nevertheless, considering his history of KD, an ECG was performed, which revealed anterolateral ischemic changes (Figure 1). Despite the ECG findings, the echocardiography report showed normal coronary artery sizes and an EF of 66%. Given the anterolateral ischemic changes observed in the ECG, a CT angiography was ordered for further evaluation. The CT angiography results did not reveal any ectasia or aneurysm caused by KD complications. However, the imaging study

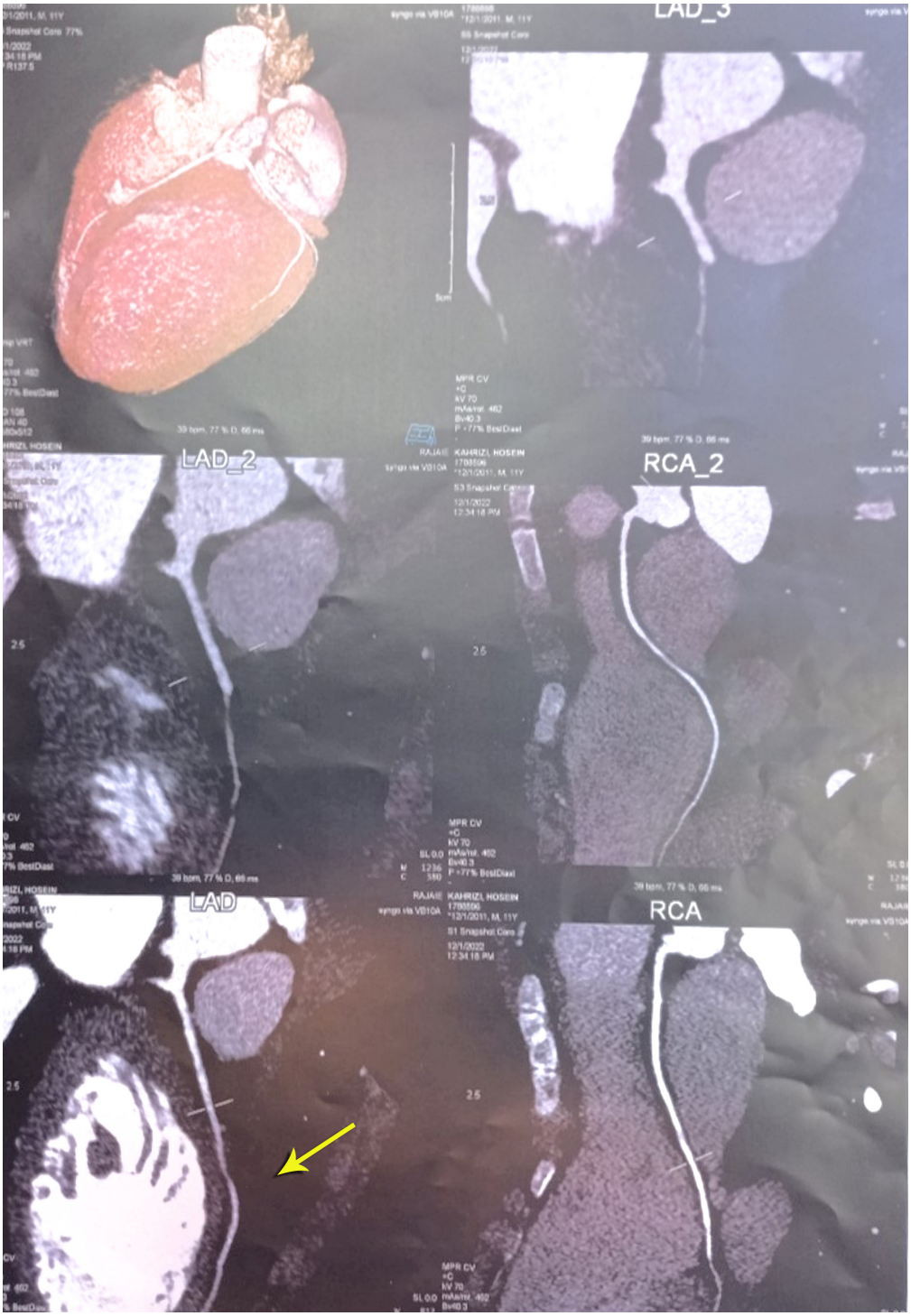


Figure 2. Computed Tomography Angiography
Arrow shows the narrowing of the LAD in the muscle (myocardial bridging)
LAD, Left Anterior Descending artery; RCA, Right coronary artery

identified a physiological myocardial bridge in the patient's LAD (Figures 2 and 4). Three weeks later, a follow-up ECG was performed, which showed a decrease in the anterolateral ischemic changes. Despite this improvement, the patient continued to experience symptoms (Figure 3). Considering the CT angiography findings, which indicated a myocardial bridge in the LAD, and in consultation with heart electrophysiology experts, an anatomical-physiological diagnosis of the myocardial bridge was suggested for the patient. It is noted that anatomical-physiological changes are commonly observed in viral diseases and typically do not require any specific treatment. The inflammation is expected to subside as the disease period resolves, leading to a decrease in these changes and eventual resolution of symptoms. As the patient in this case was diagnosed with a myocardial bridge in the LAD and had no ischemic or symptomatic changes, a follow-up plan was established. Two subsequent ECGs demonstrated a significant reduction in the initial ECG changes, confirming improvement. As a result, no specific treatment plan was prescribed for the child.

Discussion

The presented case report highlights the clinical challenges in the follow-up of Kawasaki disease patients and the potential role of CT angiography as a complementary imaging modality. The patient in this case report had a history of KD with initially normal coronary artery dimensions on echocardiography, and later developed flu-like symptoms and anterolateral ischemic changes on ECG. Despite the normal echocardiography findings, CT angi-ography was

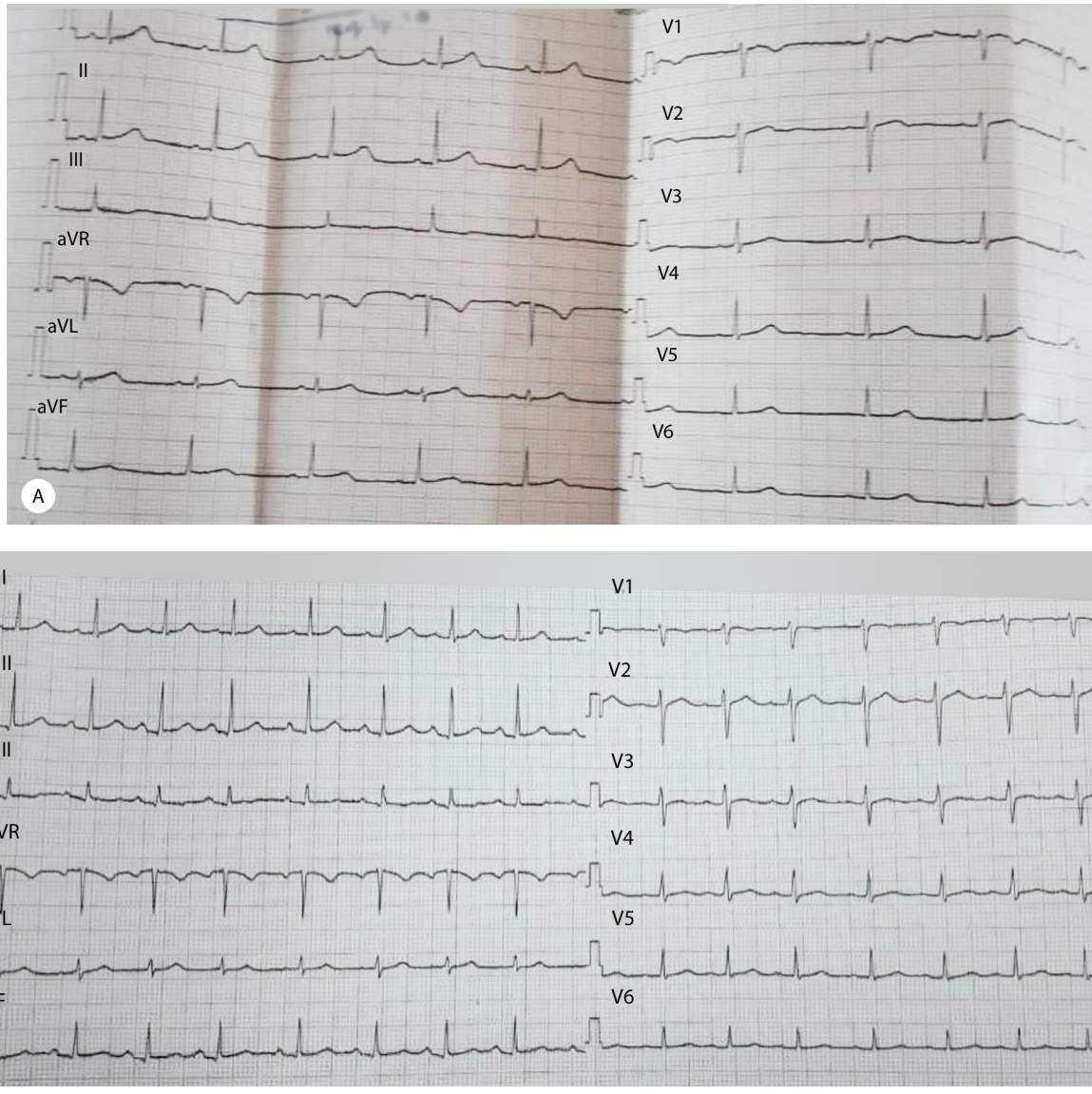
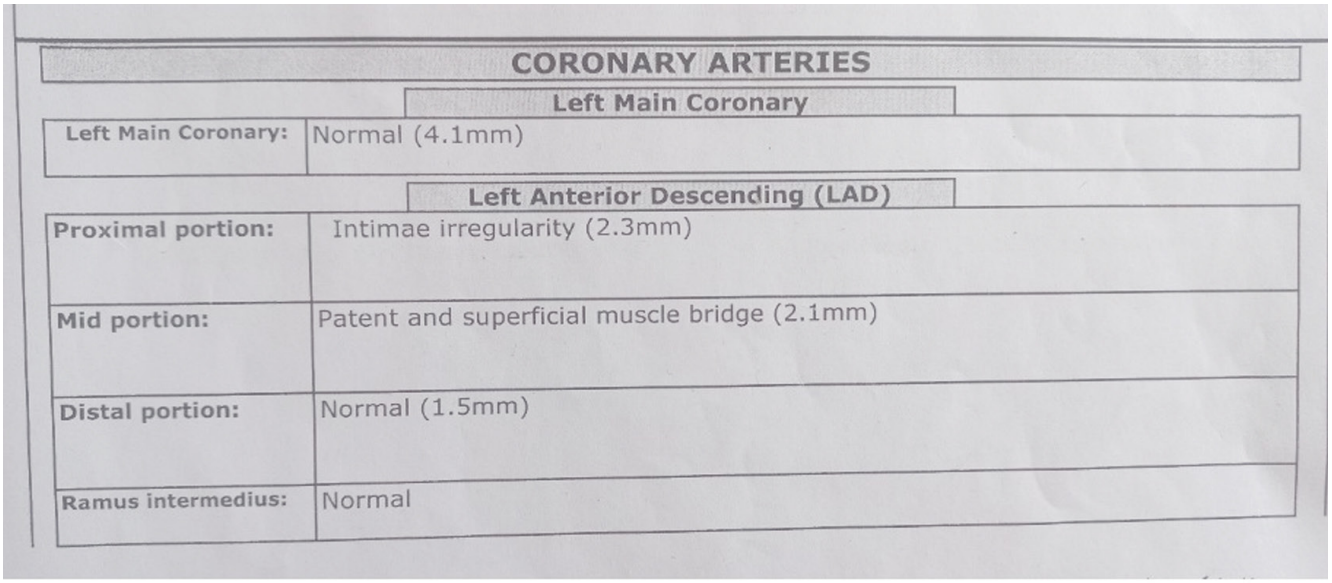


Figure 3. Electrocardiogram
Reduced Anterolateral ischemic changes in ECG (A) and ECG (B)



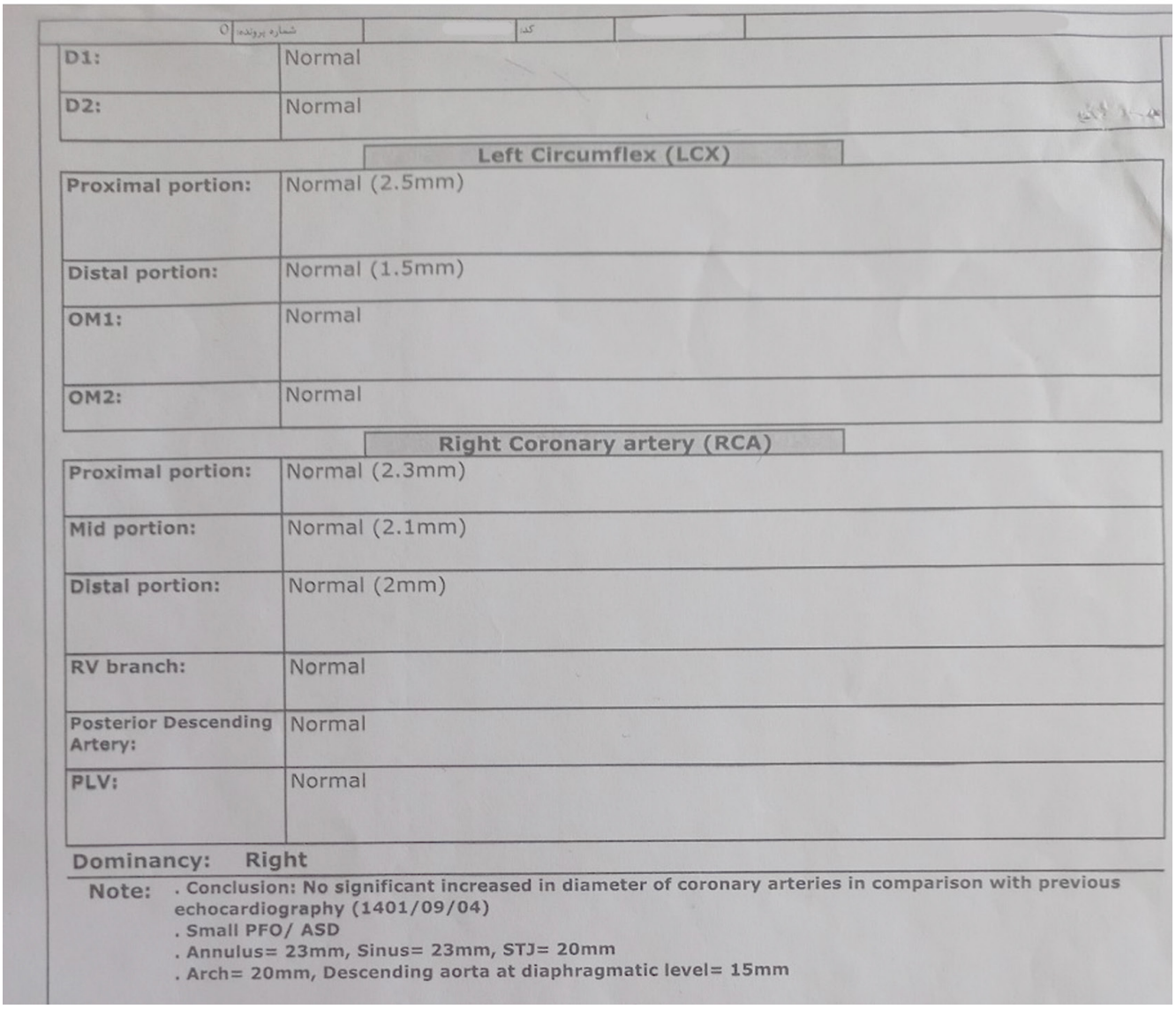
CORONARY ARTERIES

Left Main Coronary

Left Main Coronary:	Normal (4.1mm)

Left Anterior Descending (LAD)

Proximal portion:	Intimae irregularity (2.3mm)
Mid portion:	Patent and superficial muscle bridge (2.1mm)
Distal portion:	Normal (1.5mm)
Ramus intermedius:	Normal



D1:	Normal
D2:	Normal

Left Circumflex (LCX)

Proximal portion:	Normal (2.5mm)
Distal portion:	Normal (1.5mm)
OM1:	Normal
OM2:	Normal

Right Coronary artery (RCA)

Proximal portion:	Normal (2.3mm)
Mid portion:	Normal (2.1mm)
Distal portion:	Normal (2mm)
RV branch:	Normal
Posterior Descending Artery:	Normal
PLV:	Normal

Dominancy: Right

Note:
. Conclusion: No significant increased in diameter of coronary arteries in comparison with previous echocardiography (1401/09/04)
. Small PFO/ ASD
. Annulus= 23mm, Sinus= 23mm, STJ= 20mm
. Arch= 20mm, Descending aorta at diaphragmatic level= 15mm

Figure 4. CT Angiography Report

performed to investigate the cause of these ischemic changes and revealed a physiological myocardial bridge in the patient's LAD. In fact, the patient's muscle bridge was an incidental or congenital finding and not a consequence of KD.

Several similar case reports and studies have indicated that CT angiography can provide valuable information for KD patients, particularly in cases where echocardiography may be inconclusive or limited in its ability to visu-alize certain coronary artery abnormalities.[6] For example, in a recent study, CT coronary angiography in children with KD was found to be effective in detecting distal coronary artery abnormalities that were not identified by echocardiography. This finding is compatible with the observations from our case report, where CT angiography revealed the presence of a myocardial bridge in the LAD, which was not detected by echocardiography.

While echocardiography remains the primary imaging tool for monitoring KD patients, the use of CT angi-ography can be considered in certain circumstances, such as when there are unexplained ischemic changes on ECG or when echocardiography findings are inconclusive.[3,5] In our case report, the presence of ischemic changes on ECG despite normal echocardiography findings prompted the use of CT angiography, which led to the identification of the myocardial bridge. It is essential to weigh the potential benefits against the risks associated with CT angi-ography, including radiation exposure and the need for intravenous contrast agents, particularly in pediatric pa-tients. However, the additional information provided by CT angiography can be invaluable for patient management and prognosis, as demonstrated in our case report and the study by Singhal et al.[8]

There is still limited consensus on the optimal timing and indications for CT angiography in KD patients. Some studies suggest a 5-year interval for CT angiography, but further research is needed to establish evidence-based guidelines. Longitudinal studies comparing the diagnostic accuracy and clinical outcomes of KD patients undergo-ing routine echocardiography versus those receiving CT angiography at specific intervals could provide valuable insights.[2]

Conclusion

In conclusion, in light of the presented case report and available literature, it is evident that CT angiography can serve as a valuable diagnostic tool in the management and follow-up of Kawasaki disease patients, particularly when echocardiography findings are inconclusive or when clinical presentation raises concerns for potential coro-nary artery abnormalities. The identification of a myocardial bridge in our case report and the detection of distal coronary artery abnormalities in the study by Singhal et al underscore the diagnostic capabilities of CT angiography in revealing underlying coronary anomalies that may be missed by echocardiography. Consequently, the integration of CT angiography into the routine evaluation and follow-up of KD patients may help in the early detection of po-tentially serious complications, enabling timely intervention and improved clinical outcomes. However, consider-ing the potential risks associated with CT angiography, such as radiation exposure and the use of intravenous con-trast agents, it is crucial to carefully assess the risk-benefit ratio on a case-by-case basis, especially in pediatric pa-tients. Further research is warranted to establish evidence-based guidelines for the optimal timing and clinical indi-cations for CT angiography in Kawasaki disease patients and to evaluate its long-term impact on patient outcomes and management. Considering the number of patients who visit our center and among them there are people who want to do professional sports or are athletes and want to continue their training. It is recommended that a CT angi-ography of the coronary arteries be performed in these patients 5 years after Kawasaki disease in order to detect pos-sible abnormalities and prevent sudden death.

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