CASE REPORT

# Aborted sudden cardiac death in a young male with rheumatoid arthritis

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## Abstract

Rheumatoid arthritis (RA) causes coronary artery atherosclerosis with a similar risk as diabetes or hypertension. However, coronary artery disease (CAD) is rare in young patients, especially in those presenting as chronic total occlusion (CTO).

We report a rare case of aborted sudden cardiac death in a 26-year-old patient with a six-year history of RA. He had no cardiovascular risk factors apart from RA. He was diagnosed with severe ischaemic heart failure (HF) due to recent myocardial ischaemia with CTO, using multimodal evaluation.

RA is associated with vulnerable plaque formation and prothrombotic tendencies. Anti-rheumatic drugs are thought to prevent the progression of CAD and reduce cardiovascular risk in patients with RA. However, this patient had severe HF with CTO, despite being on RA medication. This case suggests that RA may be a major risk factor for CAD, including CTO, in young individuals.

**Keywords:** Rheumatoid Arthritis, Coronary Artery Disease, Sudden Cardiac Death, Myocardial Infarction.

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## Introduction

Rheumatoid arthritis (RA) is a systemic inflammatory disease that can involve the entire body, including the coronary artery.[1] Similar to other major risk factors such as diabetes or hypertension, rheumatoid arthritis (RA) is associated with increased risks of coronary artery disease (CAD).[1,2] RA increases the risk of CAD, including acute myocardial infarction (MI), by 1.5-fold to twofold.[2] However, since CAD is relatively uncommon in young people, severe CAD including chronic total occlusion (CTO) rarely occurs in individuals in their twenties.[3] We report a rare case of aborted sudden cardiac death due to a recent MI with CTO in a young male patient with RA.

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## Case Report

A 26-year-old man visited the emergency room of Soon Chun Hyang University Hospital, Cheonan, South Korea, complaining of chest discomfort on November 29, 2021. After visiting the emergency room, the patient experienced ventricular fibrillation twice. He was resuscitated after 12 cycles of chest compressions and 9 cycles of defibrillation. After one month of conservative management, the patient was transferred to Kyung Hee University Hospital at Gangdong, South Korea, for further evaluation and management.

He had been diagnosed with RA six years ago and was administered methotrexate 2.5mg weekly, tacrolimus 2mg daily, and prednisolone 5mg daily. While he was under medication, there were no specific symptoms and inflammatory marker levels were normal. In the 28-joint disease activity score (DAS28-ESR), up to 2.6 is known as remission, 2.6-3.2 as low disease activity, 3.2-5.1 as moderate disease activity, and over 5.1 as high disease activity.[4] The disease activity in this patient was low (DAS28-ESR 2.94). Rheumatoid factor (RF) and anti-CCP levels were elevated (Anti-CCP ≥200 U/mL, [reference range, 0-5.0 U/mL]; RF 232.5 IU/mL, [reference range, 0-15 IU/mL]). There was no history of alcohol consumption and smoking. He had no family history of cardiovascular diseases.

Blood tests after resuscitation indicated elevated serum cardiac marker levels (CK-MB 19.80 ng/mL, [reference range, 0-4.87 ng/mL]; troponin T 0.399 ng/mL, [reference range, 0.000-0.1000 ng/mL]). At the time of transfer to our hospital, cardiac marker levels had normalised, and only serum brain natriuretic peptide (1415 pg/mL, [reference range, <100 pg/mL]) was elevated. Electrocardiography revealed a persistent ST-segment elevation in the anterior leads and T-wave inversion in the precordial leads.

Echocardiography showed akinesia of the apical whole and mid anteroseptal, inferoseptal, anterior, and inferior segments with an ejection fraction (EF) of 30%, indicating ischaemia at the left anterior descending artery (LAD) and right coronary artery (RCA) territories with severe heart failure (HF) (EF, 30%, [normal range, ≥50%]; global longitudinal strain, -5.4%).

Coronary angiography revealed significant multivessel coronary artery stenoses. Left coronary angiography

revealed near-total occlusion of the LAD ostium, tight stenosis in the mid-portion of the LAD (Figures 1A and 1B), and collateral flow from the left circumflex artery (LCX) to the RCA (Figure 1B). Right coronary angiography revealed total occlusion of the proximal RCA (Figure 1C). Intervention was attempted on the RCA but failed because the wire could not be advanced through the occluded lesion.

A rheumatologist was consulted to identify other diseases that could cause CAD with CTO. Thrombophilia screening test including anti-thrombin III and autoantibody tests for systemic lupus erythematosus and antiphospholipid syndrome were also performed; however, no specific findings were observed. We also discussed the possibility of CAD caused by medications such as tacrolimus. However, the possibility of side effect was considered low because the thrombus suppression effect of the medicine was greater. Additionally, after reducing the RA medication for approximately one month, the inflammatory marker levels increased along with the patient's wrist arthralgia, resulting in increased disease activity (DAS28-ESR 5.26). Considering the opinion of a rheumatologist and the clinical features, we decided to continue the medications for RA.

Cardiac magnetic resonance imaging (MRI) was performed to evaluate the reversibility of the myocardium. Cardiac MRI revealed changes suggestive of both acute (Figure 2A) and chronic MI (Figure 2B). Moreover, left ventricle (LV) aneurysmal dilatation with severe myocardial thinning of the mid- to -apical LV was observed, suggesting chronic MI (Figure 2C and 2D). Based on these findings, it was presumed that chronic and silent MIs had occurred before the current MI event.

Based on the clinical course and multimodal imaging, the final diagnosis was severe HF due to a recent MI with CTO. Since percutaneous coronary intervention was not possible, surgical bypass and correction were the treatment options. After incising the LV aneurysmal sac in the apex, it was observed that the aneurysmal wall showed a thin layer of myocardial muscle and a few fibrotic scar tissues, suggesting chronic MI. A LV aneurysmectomy with an endoventricular patch repair was performed. Coronary artery bypass graft surgery was undertaken by connecting the left internal mammary artery to distal LAD and right internal mammary artery to distal RCA. The patient recovered without any serious complications.

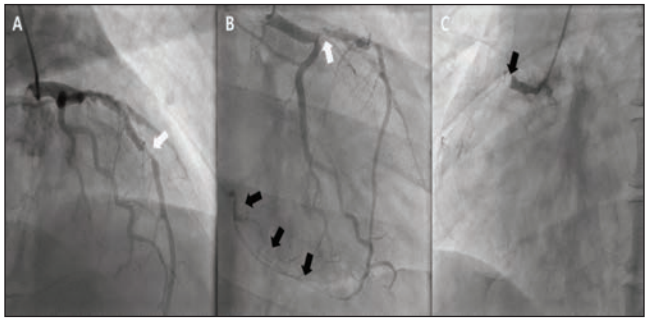


**Figure-1:** Coronary angiography: (A) Severe stenosis (white arrow) in the mid-LAD is noted. (B) Total occlusion (white arrow) of the LAD ostium and collateral flow from the LCX to the RCA (black arrows) is observed. (C) Total occlusion (black arrow) of the proximal RCA is noted.

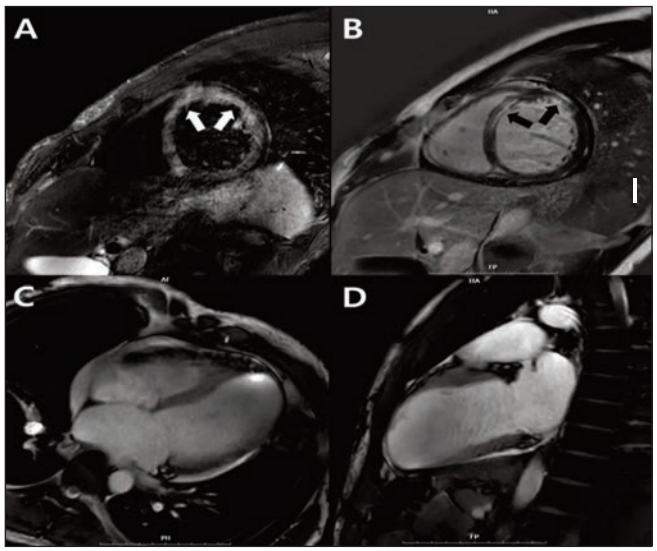


**Figure-2:** Cardiac magnetic resonance imaging: (A) In the T2-weighted image, a high signal (white arrows) is observed in the anterior, anteroseptal, and anterolateral walls of the mid-LV. (B) Delayed subendocardial enhancement (black arrows) in the anterior and anteroseptal walls of the mid-basal LV is noted. (C) Myocardial thinning at the septal wall of the mid to apical LV is observed in the baseline four-chamber image. (D) Myocardial thinning at the anterior and inferior walls of the mid to apical LV is seen in the baseline two-chamber image.

A follow-up echocardiography and coronary computed tomography angiography (CCTA) was performed 4-months after the surgery. On CCTA, graft patency was well maintained and there were no specific findings in the LV aneurysmectomy site. During follow-up echocardiography, although the RCA territory ischaemia had recovered, the HF had not fully recovered (EF, 38%).

The patient was treated with sacubitril/valsartan and a beta antagonist in addition to dual antiplatelet and anti-rheumatic drugs including methylprednisolone 4mg daily and methotrexate 12.5mg weekly. The patient did not experience any ischaemia-related symptoms and underwent regular follow-up care in the outpatient cardiology clinic.

## Discussion

CTO is defined as total occlusion maintained for at least 3 months.[5] Most CTOs occur as a result of occlusion of the

thrombotic coronary artery due to soft plaque rupture and subsequent organisation of thrombotic material.[6] Lipid-rich and soft plaques are predominantly observed in younger patients.[6] In addition, the CTO lesion of the present case was not calcified and seemed to be caused by lipid-laden plaques with necrotic core and organized thrombus. In this patient, RA was the only risk factor for CAD with CTO.

Although the pathophysiology of the thrombosis in RA remains uncertain, RA has prothrombic tendencies and causes problems in the coagulation and fibrinolytic systems to provoke a prothrombic state.[7] The initiation of coagulation, fibrin cross-link rate, and time to reach maximal clot formation are shorter in patients with RA than in healthy subjects.[8,9] The citrullinated fibrinogen in plasma was also increased in patients with RA.[8] This difference may be related to the prothrombic tendency in RA.[8]

RA also affects the formation of vulnerable plaques related to acute coronary syndrome (ACS).[10] CD4+CD28– T cells are increased in patients with RA, and frequently identified in coronary artery plaques in patients with ACS.[1] The frequency of CD4+CD28– T cells is thought to be related to the severity of CAD by constructing plaques and causing endothelial and vascular damage.[1] Additionally, tumour necrosis factor-α, which increased in patients with RA, is involved in the regulation of CD28 expression, which can affect the expression of CD4+CD28– T cells.[1]

Based on these mechanisms, anti-inflammatory drugs are thought to reduce the onset of CAD including ACS.[1,11] However, in this case, although the patient took medications and the RA activity was under control, severe CAD had occurred. Considering the high titer of autoantibodies for RA, administration of several medications for RA, and rapid increase in disease activity of RA after discontinuation of medication, it is likely that RA activity was high, which may have induced CAD including CTO.

## Conclusion

A rare case of severe HF due to a recent MI with CTO is reported. The patient was a young male with RA on medication and no other cardiovascular risk factors. It is suggested that RA is a major risk factor for CAD, including CTO, in young adults.

**Informed consent:** The authors have obtained written informed consent from the patient for publishing his case report.

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NK: Writing, editing, data collection and final approval.
SHC: Data interpretation and final approval.
IHY: Concept, supervision and final approval.