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Case Report

A survival case of a young adult patient with ST-elevated myocardial infarction with high levels of lipoprotein(a)

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ABSTRACT

A 23-year-old Japanese man presented to a nearby hospital with a complaint of chest pain. In terms of the risk factors for cardiovascular events, there were no abnormal findings in past medical examinations and no smoking history. The 12-leadelectrocardiogram revealed ST-elevation in V1-V6, I, and aVL, and he was diagnosed with acute myocardial infarction. Emergency coronary angiography findings revealed total occlusion of the left main trunk and collateral vessels from the right coronary artery to the left anterior descending artery. He underwent emergency percutaneous coronary intervention and placement of drug-eluting stent under the support of venoarterial-extracorporeal membrane oxygenator (VA-ECMO). On day 8 after the onset, transthoracic echocardiography revealed that cardiac function improved with left ventricular ejection fraction from 10% to 20% and VA-ECMO was successfully removed. Alternatively, laboratory findings revealed abnormally high levels of serum lipoprotein(a) [Lp(a), 74 mg/dL] despite the normal levels of low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, and triglyceride. In addition, computed tomography angiography revealed atherosclerosis and stenosis of internal and external carotid arteries, subclavian artery, and renal artery. The abnormally high levels of serum Lp(a) could influence systemic atherosclerosis as well as the onset of myocardial infarction in our young adult patient.

<**Learning objective:** This was a rare survival case of a young adult patient with acute extensive myocardial infarction owing to plaque rupture of the left main trunk. Additionally, he had atherosclerosis of the whole body, including the carotid artery, subclavian artery, and renal artery. Blood test results revealed abnormally high levels of serum lipoprotein(a) [Lp(a)] despite the normal levels of low-density lipoprotein cholesterol. Lp(a) could strongly influence coronary atherosclerosis and myocardial infarction.>

Introduction

Hyperlipidemia, such as high levels of low-density lipoprotein cholesterol (LDL-C), is well-known as a prognostic factor of cardiovascular diseases. In addition, hydroxymethylglutaryl coenzyme-A reductase inhibitor drugs called statins are broadly used for stabilization and regression of coronary artery plaque as well as to decrease the occurrence of cardiovascular events [1]. However, it becomes a problem that statin therapy dose not sufficiently decrease cardiovascular events, the so-called “statin residual risks” [2]. Conversely, lipoprotein(a) [Lp(a)], a lipid subclass, has been reported as a strong predictor of cardiovascular events, independent of LDL-C [3]. Herein, we report a rare survival case of a young adult patient with systemic atherosclerosis and acute myocardial infarction of the left main trunk with abnormally high levels of serum Lp(a).

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Case report

A 23-year-old Japanese man was brought to a nearby hospital in an unconscious state after a complaint of chest pain. He had no specific previous histories, medications, or smoking history. The 12-lead electrocardiogram revealed ST-elevation in V1-V6, I, and aVL, which led to the diagnosis of acute myocardial infarction. Ventricular fibrillation (Vf) occurred, and he was under cardiogenic shock. Cardiopulmonary resuscitation, including the use of adrenaline and electrical defibrillation, was immediately performed to treat Vf. Because the chest X-ray showed severe pulmonary congestion and his spontaneous respiration stopped, he was intubated and required the support of mechanical ventilator, intra-aortic balloon pumping (IABP), and venoarterial-extracorporeal membrane oxygenator (VA-ECMO).

Emergency coronary angiography (CAG) revealed no significant stenosis in the right coronary artery (RCA), whereas total occlusion of the left main trunk (LMT) and collateral vessels occurred from RCA to the left anterior descending artery (LAD) (Fig. 1A–C). The patient then underwent emergency percutaneous coronary intervention (PCI), including thrombus aspiration and percutaneous old balloon angioplasty. Intravascular ultrasound (IVUS) demonstrated atherosclerotic lesions comprising mixed eccentric plaque (fibrous and fibro-fatty) from LMT to LAD#6 (Fig. 2). Finally, the patient underwent placement of everolimus-eluting coronary stent (XIENCE Sierra® 4.0 × 18 mm, Abbott Vascular, Santa Clara, CA, USA) in the culprit lesion, which trapped the ostium of the left circumflex coronary artery (LCX), and thrombolysis in myocardial infarction III coronary artery flow was successfully achieved in LAD and LCX (Fig. 1D). However, his cardiac function recovered poorly after PCI. Five days after the onset, he was transferred to our hospital because it was difficult to remove VA-ECMO support, resulting in a possibility of heart transplantation.

When he was transferred to our institute, transthoracic echocardiography revealed left ventricular ejection fraction (LVEF) of 10% with diffuse severe hypokinesis of the extensive anterior wall motion. However, at day 8, his cardiac function recovered with LVEF of 20%, and VA-ECMO was successfully removed. He was also weaned from IABP at day 9. After being discharged from the intensive care unit at day 13, he received guideline-established optimal medical therapy for heart failure with beta-blockers, angiotensin-converting-enzyme inhibitors, mineralocorticoid receptor antagonists, and cardiac rehabilitation. He was also successfully weaned from intravenous inotropic drugs such as dobutamine and milrinone at day 18. He continued internal medications, including 100 mg/day aspirin, 3.75 mg/day prasugrel, 2.5 mg/day rosuvastatin, and 15 mg/day lansoprazole.

Conversely, the laboratory findings on admission revealed the total cholesterol (TC) value of 145 mg/dL, high-density lipoprotein cholesterol (HDL-C) of 43 mg/dL, LDL-C of 80 mg/dL, and triglycerides (TG) of 111 mg/dL under internal use of statin (2.5 mg/day rosuvastatin). Moreover, we examined the lipid profile in further detail. The examination of lipoprotein fractionation revealed the abnormally high levels of serum Lp(a) of 74 mg/dL. In addition, 3D-computed tomography angiography (3D-CTA) showed atherosclerosis and stenosis of the left internal and external carotid artery, left subclavian artery, and right renal artery (Fig. 3A–C). Although the medication therapy for dyslipidemia was uptitrated to full dose of statins (rosuvastatin of 10 mg/day) at day 60, the level of serum Lp(a) was almost the same (76 mg/dL) despite the decrease in LDL-C from 80 mg/dL to 45 mg/dL.

He gradually recovered owing to comprehensive heart failure therapy by the heart team, including medical therapy based on guidelines and cardiac rehabilitation. He underwent restudy of CAG and IVUS at day 53, and there was no progression of coronary plaque and in-stent restenosis. Although transthoracic

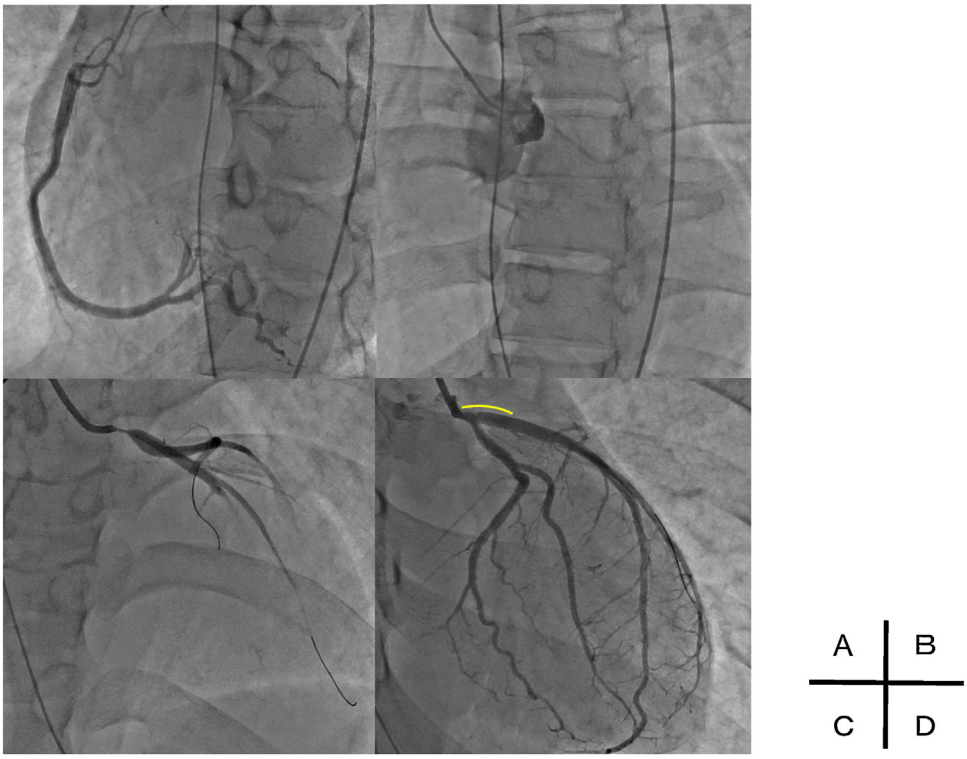

Fig. 1. Images of coronary angiography and post-percutaneous coronary intervention event. No significant stenosis was noted in the right coronary artery (RCA) (A). Total occlusion of the left main trunk (LMT) (B, C) and collateral vessels from RCA to left anterior descending artery (LAD) were detected. Everolimus-eluting coronary stent (XIENCE Sierra® 4.0 × 18 mm) was placed from LMT to LAD#6, as indicated by a yellow line (D).

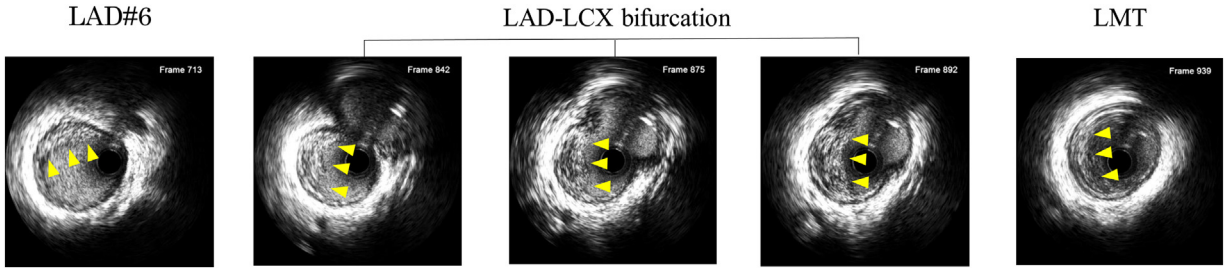

Fig. 2. Images of intravascular ultrasound demonstrated atherosclerotic lesions comprising lipid-rich plaque from left main trunk (LMT) to left anterior descending artery (LAD)#6, as indicated by the yellow arrows.
LCX, left circumflex coronary artery.

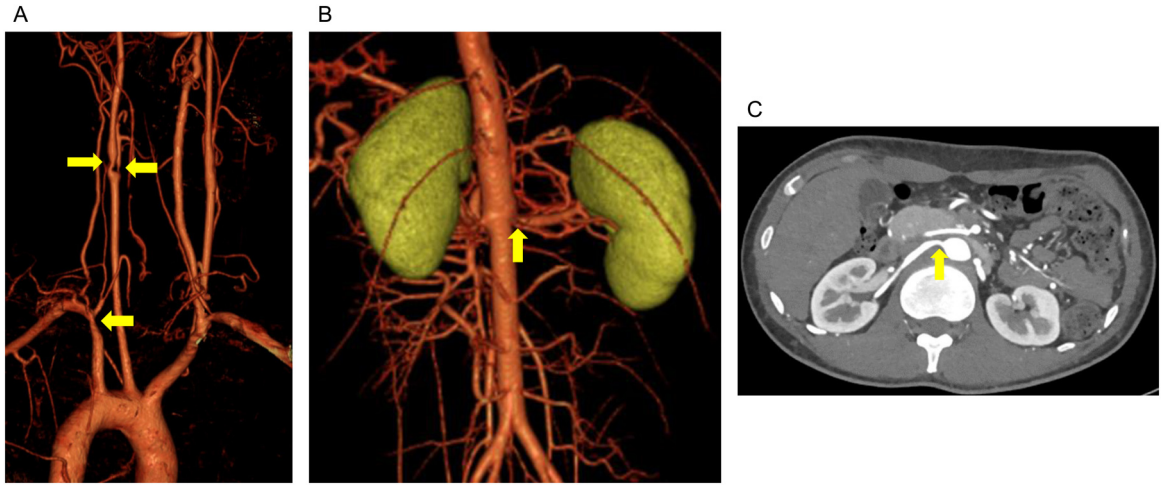

Fig. 3. Three-dimensional-computed tomography angiography. Moderate stenotic lesions were noted in the left internal and external carotid artery (A), left subclavian artery (A), and left renal artery (B, C), as indicated by yellow arrows.

echocardiography showed that cardiac function was considerably reduced with LVEF of 24% and enlarged LV end-diastolic diameter of 64 mm, he was successfully discharged at day 61 after the onset of acute myocardial infarction.

Discussion

Lp(a) as a biomarker of atherosclerosis and cardiovascular disease

Several studies have reported that Lp(a) was an independent and strong predictor of atherosclerosis and future cardiac events, stroke, and peripheral arterial disease [3]. Lp(a) is a lipid subclass, comprising apoprotein B-100 binding with apolipoprotein(a) by disulfide binding. The mechanisms of Lp(a)-induced atherogenesis are reported as follows: inhibition of nitric oxide and endothelial dysfunction, induction of intercellular cell adhesion molecule-1, and vascular cell adhesion molecule-1, interleukin-8, and plasmin-mediated inflammation and extracellular matrix degradation, foam cell formation, and smooth muscle proliferation [4]. Although it has been established that lipid-lowering therapy with statins is effective for the regression of coronary plaque and decrease of cardiovascular events [1], some patients showed recurrence of cardiovascular events despite the use of statin. Importantly, Lp(a) is one of the residual risk factors after statin therapy [5,6]. In this case, the other residual risk factors were not recognized such as increased high-sensitivity C-reactive protein level (0.04 mg/dL) and remnant-like particle cholesterol level (1.9 mg/dL). Furthermore, this patient has no obesity (body mass index of 19.4 kg/m^2) and family history of myocardial infarction or stroke in particular. In addition, lipid profile at medical checkup 1 year previously showed normal range of LDL-C (96 mg/dL), HDL-C (56 mg/dL), and TG (85 mg/dL) with no medicines. However, the finding of IVUS on CAG revealed advanced atherosclerosis with mixed eccentric plaque (fibrous and fibro-fatty), and plaque rupture causes ST-elevation myocardial infarction. Furthermore, 3D-CTA showed atherosclerosis and stenosis of the whole body, not only of the coronary artery but also of the carotid, subclavian, and renal arteries. Recently, Mitsuda et al. reported that the Lp(a) levels indicate the probability of adverse cardiac and cerebrovascular events after myocardial infarction in the Japanese population [7]. Their data showed that the median serum Lp(a) level was 16.5 mg/dL in patients admitted for ST-elevation myocardial infarction after primary PCI. In addition, the median Lp(a) level was 29.0 mg/dL in high Lp(a) group ($\geq$16.5 mg/dL), and they showed more adverse vascular events than the low Lp(a) group ($<$16.5 mg/dL). In this case, serum Lp(a) level was extremely high, and he was younger than these patients. From the above results, high levels of serum

Lp(a) (74 mg/dL) might strongly influence systemic atherosclerosis as well as the onset of myocardial infarction, even in a young adult patient.

The medical treatment for high levels of Lp(a)

From the results of the LIPID study, which examined the effect of pravastatin on cardiovascular events in patients with stable coronary heart disease, the plasma Lp(a) concentration did not decrease with statin therapy [8]. In fact, the serum levels of Lp(a) had not decreased, although we uptitrated statin (10 mg/day rosuvastatin). Another report revealed that the use of niacin added to statin was useful in decreasing Lp(a) [9]. Therefore, we added tocopherol nicotinate of 600 mg/day to rosuvastatin of 10 mg/day. However, the Lp(a) level had not remarkably changed, whereas the blood levels of TG, TC, and LDL-C had decreased, that of HDL-C had increased. Recently, Gaudet et al. determined that alirocumab, a monoclonal antibody to proprotein convertase subtilisin/kexin type 9 inhibitor strongly and sustainably reduces Lp(a) level [10]. Whether this Lp(a)-lowering therapy could contribute to the decrease in cardiovascular events remains to be established, however, we should aggressively consider conducting Lp(a)-lowering therapy in addition to the current medical therapy and cardiac rehabilitation even in young patients with high Lp(a) level.

In conclusion, the screening of blood Lp(a) level could be clinically significant for risk stratification of future cardiovascular events in young adult patients with severe atherosclerosis despite normal levels of LDL-C.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgments

There was no previous presentation about the contents reported in the article.

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