Case Reports

Three Cases of Acute Myocardial Infarction Due to Coronary Embolism
Treatment Using a Thrombus Aspiration Device

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SUMMARY
In this report, we describe three patients with acute myocardial infarction due to coronary embolism who were successfully treated using a thrombus aspiration device. Thrombus aspiration is shown to be a feasible and effective strategy for the treatment of acute coronary embolism. (Jpn Heart J 2004; 45: 861-866)

Key words: Myocardial infarction, Coronary embolism, Thrombus aspiration, Atrial fibrillation

RUPTURE of atherosclerotic plaques and subsequent thrombus formation are known to be a major cause of acute myocardial infarction. Coronary embolism is believed to be a cause of acute myocardial infarction when emergent coronary angiography shows perfectly normal coronary trees, except for the finding of coronary artery occlusion. However, it is difficult to distinguish the origin of an occluded thrombus, in other words, whether it arose from inside or outside the coronary artery. Recently, the removal of a coronary thrombus has become possible using a coronary thrombectomy catheter. Histological examination of the thrombus verified the correct diagnosis of coronary embolism. Here, we report three cases with coronary embolism treated using coronary aspiration devices.

CASE REPORT

Case 1: An 88-year-old woman with a history of paroxysmal atrial fibrillation (Af) was transferred to the coronary care unit of our hospital due to consciousness disturbance. A 12-lead electrocardiogram (ECG) showed Af with a ventricular rate of 32 beats per minute, ST elevation in leads II, III and aVf, and reciprocal ST depression in leads V1-V4, which are consistent with an acute myocardial in-
farction (AMI). She recovered from the consciousness disturbance immediately after temporary pacing. Emergency coronary angiography (CAG) revealed a large amount of embolus material (Figure 1A) in a proximal segment of the right coronary artery (RCA). Furthermore, the tail of this material seemed to protrude from the ostium of the RCA. After the first injection of contrast medium, the thrombus material migrated to the distal segment of the RCA (Figure 1B). We attempted thrombus aspiration using the Rescue percutaneous thrombectomy system (Boston Scientific, Maple Grove, Minnesota, USA). After several mobilizations of the catheter and TIMI (Thrombolysis in Acute Myocardial Infarction) 3 flow and recanalization were achieved (Figure 1C). As a result, the thrombus material was completely removed from the RCA. Neither intracoronary thrombolysis nor percutaneous transluminal intervention was performed. Histological examination of the aspirated material showed a fresh thrombus without evidence of an atherosclerotic component (Figures 2a, 2b).

Case 2: A 50-year-old man with a history of hyperlipidemia experienced chest pain followed by syncope. He was transferred to our coronary care unit 60 minutes after the onset of syncope. A 12-lead ECG showed ST elevation in leads II, III, and aVF. After an intravenous bolus injection of heparin and thrombolytic agents, an emergency CAG showed that the ostium of the RCA was occluded (Figure 1D). After an injection of contrast medium, the thrombus material migrated to the distal segment of the RCA. The ostium of the RCA showed no stenotic lesion (Figures 1E-F). Thrombus aspiration using the Rescue percutaneous thrombectomy system was performed. After four mobilizations of the catheter through the occlusion, recanalization was achieved, accompanied by distal small branch occlusion (Figure 1G). Percutaneous transluminal intervention was not performed. Histological examination of the aspirated material also showed a fresh thrombus without evidence of an atherosclerotic component (Figures 2c, 2d). He had an attack of paroxysmal AF during the hospital stay but showed no evidence of coagulation abnormality. He was treated with oral anticoagulation medications and aspirin.

Case 3: An 85-year-old man with a history of hypertension, chronic AF, and cardiogenic cerebral infarction who was receiving insufficient oral anticoagulation medications was transferred to our coronary care unit with chest pain. On admission, he showed hypotension and consciousness disturbance. A 12-lead ECG demonstrated AF with a ventricular rate of 56 beats per minute and ST elevation in leads I, aVL and V1-6. A diagnosis of a broad anterior AMI with cardiogenic shock was made. After intravenous thrombolytic agents, an intraaortic balloon pump was inserted and dobutamine was administered to stabilize his hemodynamic condition before an emergency CAG. The emergency CAG showed a large filling defect suggestive of an intracoronary thrombus in the left main trunk (Fig-
MYOCARDIAL INFARCTION DUE TO CORONARY EMBOLISM

Figure 1. A-C: An emergency CAG in case 1 showed a large filling defect in the proximal segment of the RCA and the tail of this material protruded from the ostium of the RCA (A, indicated by the arrow). The embolic material migrated downstream to the distal segment of the RCA after the initial injection of contrast medium (B, indicated by the arrow). Finally, normal coronary flow was obtained immediately after aspiration (C).

D-G: An emergency CAG in case 2 showed a large filling defect (D, indicated by the arrow) in the proximal segment of the RCA. After injection of contrast medium, the ostium of the RCA showed no stenotic lesion (E) and this material migrated downstream to the distal segment of the RCA (F, indicated by the arrow). Finally, recanalization of the RCA was obtained with distal small branch occlusion (G).

H-J: An emergency CAG in case 3 showed a large filling defect in the left main trunk (H), resulting in the distal migration of thrombi to both the left anterior descending (LAD) and the circumflex (LCx) arteries (I). Recanalization of the LAD and LCx arteries was achieved by thrombus aspiration and coronary stenting. A repeat CAG showed no significant stenotic lesions and a fully patent stented segment (indicated by dotted arrow), without evidence of loss of distal branches (J).
ure 1H) resulting in the distal migration of the thrombus to both the left anterior descending (LAD) and the left circumflex (LCx) arteries after the injection of contrast medium (Figure 1I). We attempted thrombus aspiration using a 6Fr monorail aspiration catheter (Thrombuster/Kaneka, Osaka, Japan), followed by repeated manual suctions, and recanalization of the LAD with TIMI 3 flow was achieved. Because coronary flow of the LCx artery could not be completely reestablished even after thrombus aspiration, a coronary stent (2.5 mm ACS RX Multi-Link stent) was implanted in the artery with residual stenosis due to thrombus. Recanalization of the LAD and LCx arteries by TIMI 3 was performed and flow was finally obtained. The intraaortic balloon pump was withdrawn 2 weeks after the AMI onset. A repeat CAG showed no stenotic lesions and no loss of dis-

Figure 2. a-f: In all three cases (case 1: a, b; case 2: c, d; case 3: e, f), histologic images of the aspirated materials showed fresh thrombi containing abundant erythrocytes, leukocytes, and platelets without evidence of an atherosclerotic component (a, c, e; x 2, b, d, f; x 100, H&E).
tal branches 4 weeks after the AMI onset (Figure 1J). Histological examination of the aspirated material also demonstrated fresh thrombus without evidence of an atherosclerotic component (Figures 2e, 2f).

**DISCUSSION**

Plaque disruption with a superimposed thrombosis at an atherosclerotic site is the major cause of acute coronary syndrome. However, it has been reported that between 1% and 7% of patients do not have underlying atherosclerotic coronary disease. Because a definite diagnosis of coronary embolism has been extremely difficult so far, the prevalence might be underestimated.

In the present three cases, typical angiographic images and the absence of significant stenosis of the site of the culprit lesion after resolution of thrombus confirmed the diagnosis of acute coronary embolism. All three patients had paroxysmal or chronic Af, suggesting that occlusive materials in the culprit lesion originated from the left atrial thrombus.

Although balloon angioplasty and stenting have been established as safe and effective therapies in the management of AMI, thrombotic occlusion is commonly present at the site of the culprit lesion, and distal thrombus embolization after recanalization remains a serious problem. Various challenging modalities for intracoronary thrombus in an atherosclerotic lesion have been described, such as the percutaneous Fogarty maneuver, thrombus aspiration before balloon angioplasty and/or stenting, and the use of a mechanical protection device for distal embolization. However, little information is available about the treatment of acute myocardial infarction due to coronary embolism.

We attempted only thrombus aspiration in two cases, and both thrombus aspiration and coronary stenting in one case. Angiography proved to be successful in all three cases. Although we did not perform an intravascular ultrasound study, which would possibly verify the lack of atherosclerotic change, we believe that coronary embolism was a major problem because angiography showed an almost normal appearance after the aspiration. Despite the limited number of patients, it was demonstrated for the first time that the embolized materials in the coronary artery were fresh thrombi in all three patients with paroxysmal or chronic Af. Moreover, thrombus aspiration was shown to be a feasible and effective strategy for the treatment of acute coronary embolism causing AMI.

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REFERENCES