

Successful and Safe Retrieval of a Thrombus from the Lumen of a Guiding Catheter during Percutaneous Coronary Intervention

Takao Konishi^{1,2*}, Naohiro Funayama¹ and Hiroshi Nishihara²

¹Department of Cardiology, Hokkaido Cardiovascular Hospital, Sapporo, Japan

²Department of Translational Pathology, Hokkaido University School of Medicine, Sapporo, Japan

Abstract

A 57-year-old man was hospitalized with chest pain of 1-h duration. Emergency coronary angiography revealed a total occlusion of a non-collateralized distal (segment 3) right coronary artery by a large thrombus. Multiple aspiration thrombectomies of the segment 3 lesion were performed, after which the thrombus migrated inside the guiding catheter. To prevent systemic embolization at the time of extraction, a double guiding procedure was performed to ensure that no thrombus was protruding from the tip of the catheter. The guiding catheter and a large red thrombus were ultimately safely extracted, while maintaining negative pressure in the catheter lumen with a syringe. The patient was discharged from the hospital on the 14th day free from chest pain. The histopathology of the aspirated thrombus was consistent with a coronary arterial embolization. This case indicates that, in patients with acute MI, aspiration thrombectomy performed for the prevention of thrombotic embolization can be safe and effective.

Keywords: Aspiration thrombectomy; Systemic embolization; Coronary embolism

Introduction

Aspiration thrombectomy is no longer recommended as a routine procedure for ST segment elevation (STE) myocardial infarction (MI) since its use during percutaneous coronary interventions (PCI) does not improve long-term clinical outcomes and may increase the risk of stroke [1,2]. We report a case of successful and safe retrieval of a thrombus from inside a guiding catheter in a patient presenting with an acute inferior MI.

Case Report

A 57-year-old man was hospitalized with chest pain of 1-h duration. His single coronary risk factor was dyslipidemia. On physical examination, his pulse was 51 bpm, blood pressure 113/77 mmHg, and a 3rd heart sound was audible on auscultation. An electrocardiogram showed ST segment elevation in leads II, III, aVF, V5-V6, ST segment depression in leads V1-V3 and 2nd degree atrioventricular (AV) block (Figure 1). A transthoracic echocardiogram showed marked hypokinesis of the infero-lateral wall, a left ventricular ejection fraction at 55% and mild mitral regurgitation. There was no thrombus in the left atrial appendage, and no atrial septal defect or foramen ovale. The laboratory tests revealed a $7.6 \times 10^3/\mu\text{l}$ white blood cell and $25.0 \times 10^4/\mu\text{l}$ platelets counts, 13.9 g/dl hemoglobin, 512 creatine kinase and 39.2 IU/l MB fraction, 716 ng/l troponin-T, 2.0 $\mu\text{g/ml}$ d-dimer and 0.11 mg/dl C-reactive protein serum concentrations.

The patient received a 2,000-units intravenous bolus of unfractionated heparin in the catheterization laboratory, before undergoing emergency coronary angiography, which revealed a total occlusion of a non-collateralized distal (segment 3) right coronary artery (RCA) by a large thrombus (Figure 2A) and no atherosclerotic irregularities in the other coronary segments. After the administration of an additional 2,000 units of unfractionated heparin, an emergent percutaneous coronary procedure was performed via the right radial arterial approach, using a 6F Profit JAL 1.0 guiding catheter (Goodman Co. LTD. Nagoya, Aichi, Japan). After crossing the segment 3 lesion with a ASAHI[®] SIONTM guidewire (Abbott Laboratories. Abbott Park, IL), the AV nodal branch (segment 4AV) was recanalized, though the posterior descending artery (segment 4PD) remained occluded. A total of 5 aspiration thrombectomies of the segment 3 lesion was performed, which occluded segment 4AV instead of recanalizing segment 4PD



Figure 1: Twelve-lead electrocardiogram. Pattern of acute inferior MI with infero-posterior STE.

***Corresponding author:** Takao Konishi, Department of Cardiology, Hokkaido Cardiovascular Hospital, Sapporo, Japan, Tel: +81-11-563-3911; Fax: +81-11-551-3109; E-mail: takaokonishi0915@gmail.com

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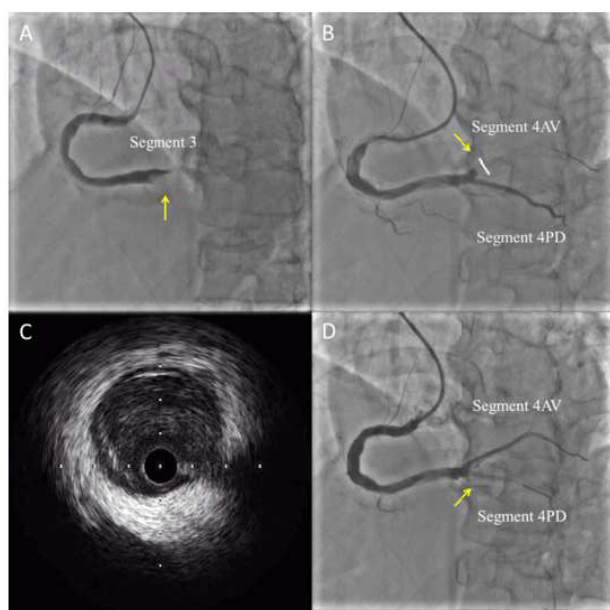


Figure 2: Emergency coronary angiography and percutaneous coronary intervention.

A. Left anterior oblique view of total occlusion of a non-collateralized distal RCA (segment 3) with a large thrombus (arrow). B. Left anterior oblique cranial view showing occlusion of segment 4AV (arrow) instead of recanalization of segment 4PD after 5 consecutive aspiration thrombectomies. C. Intravascular ultrasound study (the section at white line showed in Figure 2B) showing a fibrous thrombus around the entire circumference of the vessel in segment 4AV. D. Left anterior oblique cranial view showing recanalization of segment 4AV instead of occlusion of segment 4PD (arrow) after 3 consecutive dilatations with a 2.5 x 20 mm compliant balloon.

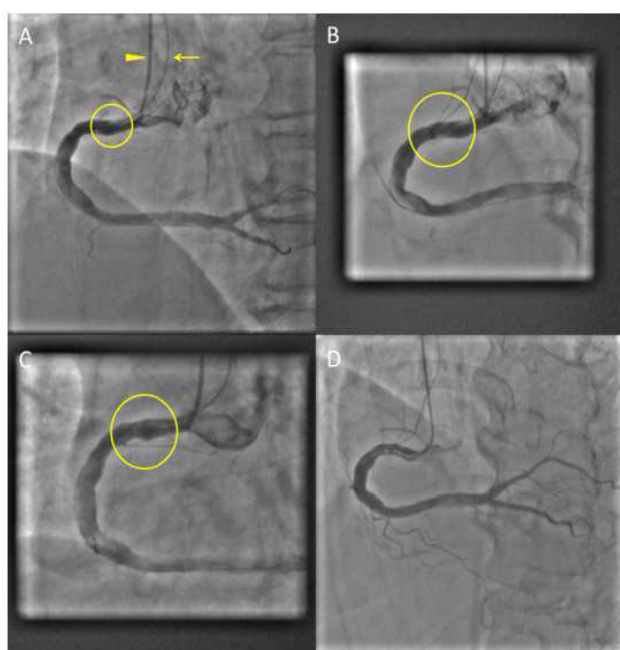


Figure 3: Guiding catheter tip angiography. Left anterior oblique (A), anteroposterior cranial (B) and deep left anterior oblique (C) views showing no protruding thrombus (circles) at the tip of the first guiding catheter (arrow), while RCA angiography was being performed with an additional angiographic catheter (arrowhead). (D) Left anterior oblique cranial view showing no significant RCA stenosis with grade 3 TIMI flow without stent implantation.

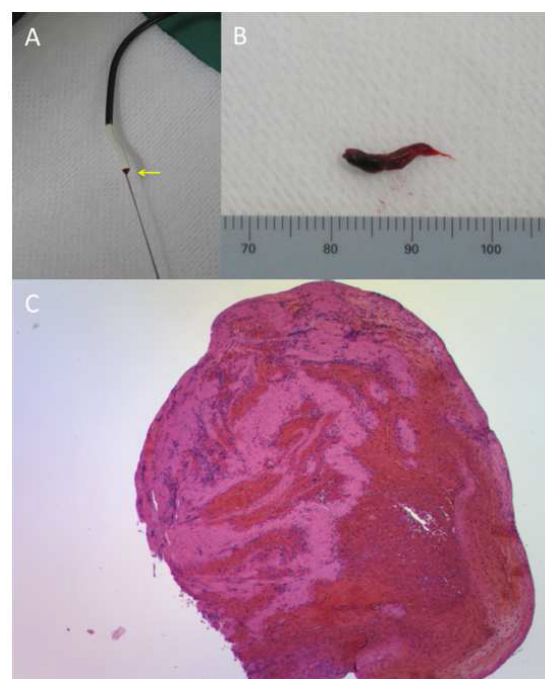


Figure 4: Extracted thrombus. A. Absence of protruding thrombus (arrow) at the tip of the guiding catheter.

B. The size of the extracted thrombus was 13 x 2 x 2 mm, large enough to adhere to the lumen of the 6F guiding catheter. C. Microphotograph of the extracted thrombus at x40 the original magnification; hematoxylin and eosin staining. The fresh thrombus is mainly composed of fibrin and red blood cells. The CD 34 (endothelial cells) and CD 68 (macrophages) were immunostaining negative (not shown), suggesting the absence of typical atherosclerotic plaque rupture.

(Figure 2B). An intravascular ultrasound study of segment 4AV revealed the presence of a fibrous thrombus around the entire circumference of the vessel (Figure 2C). A 2.5 x 20 mm compliant balloon was dilated 3 times to 10 atm, which recanalized segment 4AV instead of segment 4PD (Figure 2D). During these thrombectomies and dilatations, a few red thrombi were aspirated and the large thrombus was dislocated between segment 4PD and segment 4AV.

After the 8th manual thrombectomy, the pressure at the tip of the guiding catheter suddenly fell to 0 mmHg in the monitor, suggesting that a large thrombus had migrated inside the guiding catheter, although it was eventually aspirated from the RCA. In order to prevent a systemic embolization at the time of extraction of the guiding catheter, a double embolization procedure was performed to ensure that no thrombus was protruding from the tip of the catheter (Figure 3A). We performed multidirectional RCA angiography, using a 4F JR 4.0 catheter from the left radial arterial approach (Figure 3B and 3C). After confirming that no thrombus was protruding from the tip of the guiding catheter, we safely extracted the guiding catheter and the thrombus, while maintaining negative pressure in the catheter lumen with a syringe. The final angiography showed no significant RCA stenosis and Thrombolysis In Myocardial Infarction (TIMI) grade III flow without stent implantation (Figure 3D), and the final ultrasound study showed no plaque rupture and mild atherosclerotic irregularities in the RCA. A large red thrombus adhering to the inside the guiding catheter was extracted (Figure 4A and 4B). The patient stabilized clinically and was discharged from the hospital on the 14th day free from chest pain, on a regimen of warfarin because the histopathology of the aspirated thrombus was consistent with a coronary embolism (Figure 4C).

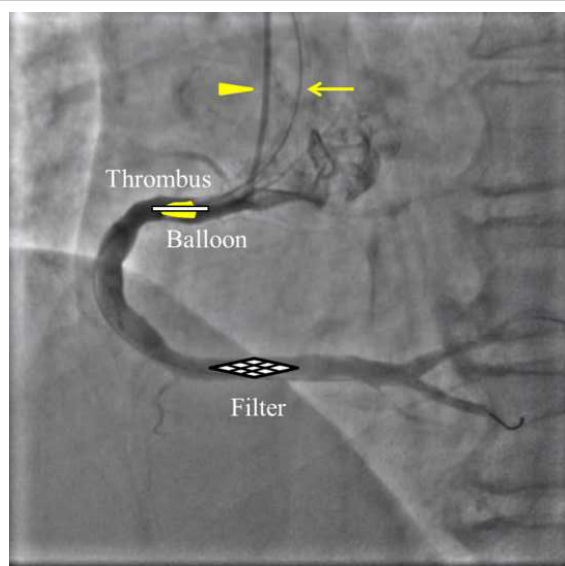


Figure 5: Double guiding procedure. In presence of a thrombus (yellow mass) protruding from a guiding catheter, the implantation of a distal protection device from a 2nd catheter (arrowhead) followed by balloon dilatation with the 1st guiding catheter (arrow) can crush and capture the thrombus.

Discussion

This is a rare case of successful and safe retrieval of a thrombus from the lumen of a guiding catheter, while angiography was performed with another angiographic catheter, in a patient presenting with an acute inferior MI. This straightforward and deliberate procedure should be of great help by preventing catastrophic systemic thromboembolisms and cerebral infarctions. The efficacy and safety of aspiration thrombectomy has been questioned recently, and its routine performance, instead of PCI alone, is not recommended during PCI for STEMI, as it does not lower the risk of cardiovascular death, recurrent MI and cardiogenic shock [1,2]. In the TOTAL OCT sub-study of patients undergoing primary PCI for STEMI, manual thrombectomy compared with PCI alone did not alleviate the pre-stent thrombus burden at the site of culprit lesion [3]. Furthermore, routine aspiration thrombectomy compared with PCI alone may increase the risk of stroke in patients presenting with MI [4-6]. In the TOTAL clinical trial of 10,732 patients, 33 (0.7%) suffered stroke within 30 days in the thrombectomy group versus 16 patients (0.3%) in the PCI alone group (hazard ratio, 2.06; 95% confidence interval, 1.13-3.75; $P = 0.02$) [6]. The putative mechanism of ischemic stroke is systemic embolization of the thrombus during removal of the aspiration or guiding catheter.

The use of an additional angiographic catheter is helpful when the first guiding catheter is filled with protruding thrombi. In absence of thrombus at its tip, the direct removal of a guiding catheter is probably without risk. However, if a thrombus is protruding from the guiding catheter, a filter implantation from the 2nd catheter followed by balloon inflation from the 1st catheter might be useful to crush and capture the thrombus (Figure 5). Importantly, the aspiration thrombectomy must be performed inside the coronary artery instead of in the sinus of Valsalva or in the aorta because of the risk of systemic embolization. If a thrombus protrudes from the tip of a guiding catheter in the left main coronary artery of a patient presenting with a MI due to a left anterior descending artery or left circumflex artery lesion, a filter for distal embolization must be delivered to the opposite branch to a culprit lesion.

Acute MI secondary to coronary embolism (Type 2, due to

ischemic imbalance) is not uncommon [7-11]. In autopsy studies, coronary embolisms have been found responsible for 10-13% of the acute MI [9,12]. Since this patient had nearly no stenosis in the other coronary segments on coronary angiography and only mild plaques in the RCA on intracoronary ultrasound, acute MI was most likely caused by a coronary embolism, which was confirmed by histopathological evaluation of the thrombus. Because paroxysmal atrial fibrillation was documented during the admission, the possible source of the embolism might be left atrium although transesophageal echocardiography was not performed.

In this case, we were able to successfully and safely retrieve the guiding catheter containing a thrombus after confirming with another angiographic catheter that it was not protruding, and restored grade 3 TIMI flow without stent implantation. The histopathology of the extracted thrombus was also useful to decide whether to initiate long-term anticoagulation.

Conclusions

This case indicates that, in patients with acute MI, aspiration thrombectomy performed for the prevention of thrombotic embolization can be safe and effective.

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