Intravascular Ultrasound Helps Differentiate Coronary Mural Hematoma from Dissection

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Intravascular ultrasound (IVUS) is a safe, accurate, and reproducible method of detecting vessel wall structure and disease. In this case, we describe a 75-year-old female with hypertension and effort angina. Coronary arteriography revealed critical stenosis in the distal right coronary artery (RCA), and intravascular ultrasound (IVUS) demonstrated spontaneous dissection flap. A significant dissection-like lesion developed at the distal part of the lesion after ballooning and stenting. Another stent was used to cover the edge dissection. The dissection-like lesion extended proximally and distally and was complicated with inferior wall myocardial infarction. IVUS revealed coronary mural hematoma which compromised the vessel lumen. We used stents to maintain adequate coronary lumen and flow. One week later, follow-up angiography demonstrated patent RCA. The patient was discharged and has had no symptom until now. Using angiography, it is difficult to differentiate coronary mural hematoma from dissection. IVUS can provide valuable information in this situation.

Key Words: Intravascular ultrasound • Coronary mural hematoma

INTRODUCTION

Contrast coronary arteriography is limited in its ability to quantify the extent or distribution of atherosclerosis or to identify changes within the vessel wall over time. Intravascular ultrasound (IVUS) lends insight into dynamic changes before and after percutaneous coronary intervention (PCI). IVUS is an imaging modality that can bring a tomographic perspective to PCI and is capable of showing the arterial wall and the lumen of the coronary arteries with high spatial resolution across the full 360-degree circumference of the vessel. Thus, it provides additional information beyond what is obtained from angiography. The use of IVUS in cardiac catheterization laboratory has continued to evolve since its introduction almost 15 years ago.1

IVUS may be used for several purposes during PCI: (1) to assess plaque morphology and composition, quantify vessel and plaque size and select the best devices for PCI;2 (2) to confirm angiographic estimates of stenosis severity; (3) to assess anatomical results and detect complications, including dissections and residual minimal cross-sectional area, after PCI;3 and (4) to assess stent deployment and in-stent restenosis. In addition, IVUS also can help differentiate between true and false coronary aneurysm and between coronary dissection and mural hematoma like this case.

CASE REPORT

A 75-year-old female with a history of regularly controlled hypertension and chronic obstructive pulmonary disease for 20 years was admitted with effort angina. Echocardiography had not shown obvious regional wall motion abnormality, and patient could not tolerate...
stress test due to degenerative disease of legs and marked exertional dyspnea. Coronary arteriography revealed significant type B1 lesion on the distal right coronary artery (RCA) (Figure 1A) and insignificant lesion at the left coronary artery.

The RCA was engaged with a 6 Fr JR5 guiding catheter, and a floppy guidewire (Runthrough NS®) was inserted into the posterior lateral branch (PLV) of the RCA. IVUS imaging of the lesion showed a cross-sectional diameter of about 4.5–5.0 mm, and eccentric large atheroma with 78% stenosis, and spontaneous plaque dissection (Figure 1B) was noticed. The culprit lesion was dilated with a Fortis® (non-compliance balloon 4.0 × 13 mm) at 14 atm. After balloon angioplasty, there was 46% residual stenosis, and a Driver® stent (4.0 × 15 mm Medtronic®) was deployed at 14 atm in the distal RCA. Post-dilatation was done with a Fortis® (non-compliance balloon 4.0 × 13 mm) at 18 atm. Angiography revealed a significant dissection-like lesion in the distal stent area (Figure 1C), so we put another Driver® stent (4.0 × 12 mm Medtronic®) at 9 atm and post-dilated with a Fortis® (non-compliance balloon 4.0 × 13 mm) at 20 atm. Unfortunately, a new proximal lesion happened and compromised the vessel lumen (Figure 1D). IVUS demonstrated coronary mural hematoma and large atheroma had compromised the vessel lumen and intact intima without obvious dissection flap (Figure 2A). So we chose a Driver® stent (4.0 × 24 mm Medtronic®) and deployed at a lower pressure of 10 atm to maintain the lumen. The coronary mural hematoma continued to progress distally (Figure 2B) and caused distal RCA nearly total occlusion resulting in inferior wall MI. Isoket 2 mg intracoronary injection was tried, and the response was poor. IVUS imaging had different finding from angiography and noticed a coronary mural hematoma at the distal RCA to the PLV branch (Figure 2C). Another un-

Figure 1. (A) Angiography revealed a significant type B1 lesion on the distal RCA. (B) IVUS of the lesion showed diameter of about 4.5–5.0 mm, eccentric large atheroma and spontaneous plaque dissection. (C) Angiography found significant dissection-like lesion in the distal stent area. (D) A proximally new lesion had happened and compromised the vessel lumen.
dersize Driver\textsuperscript{\textregistered} stent (3.0 × 30 mm Medtronic\textsuperscript{\textregistered}) was deployed at lower pressure of 9 atm in the RCA (D- > PLV) to keep the lumen patent (Figure 2D). After the procedure, the patient’s symptoms improved and electrocardiogram revealed resolution of ST segments. The patient’s peak cardiac enzymes were CK: 354 U/L, CK-MB: 37.7 U/L and troponin I: 11.2 ng/ml. One week later, follow-up angiography and IVUS demonstrated patent RCA with mild absorption and organization of coronary mural hematoma. This patient was then discharged, and has had no symptoms until now.

**DISCUSSION**

Intermediate lesion presents a challenging task in decision-making for revascularization and can be particularly troublesome in patients whose symptomatic status is difficult to evaluate. This patient had typical effort angina, but her echocardiography revealed normal wall motion. In this situation, stress test was a good option. Because she suffered from degenerative disease of the legs and marked exertional dyspnea, the patient could not tolerate treadmill test, and myocardial perfusion scan is not available in Taitung. In addition to coronary angiography, IVUS can assist decision-making, and in combination with fractional flow reserve (FFR) is better to detect significant stenosis than IVUS image alone. Measurements of FFR and coronary flow reserve using miniaturized sensors have proved useful in identifying lesions of hemodynamic significance.\textsuperscript{4,5} We did not have FFR, but the patient’s IVUS image had significant stenosis and vulnerable plaque, so angioplasty was indicated. We treated her culprit lesion with balloon angio-

![Figure 2](image-url)
plasty and stenting. Coronary angiography extremely mimicked coronary residual dissection after the first stenting. IVUS did not found disective intima, but we still treated the new finding of angiography as edge dissection, covering it with another stent and post-dilated with high pressure for full expansion of stent. Unfortunately, a new proximal lesion happened and compromised the vessel lumen.

Coronary dissection is the most common reason for acute arterial closure during PCI and can result in serious complications including death, myocardial infarction, and emergent bypass surgery. In addition, residual dissection after stenting remains a risk factor for subacute stent thrombosis in the DES era. For detection of dissections, IVUS is a more sensitive imaging modality than angiography. The circumferential and the longitudinal extent of coronary dissections can be better appreciated by IVUS. Whenever there is an indication for stenting, IVUS imaging usually reveals involvement of a longer arterial segment than can be appreciated angiographically. This additional involvement may be particularly important in cases of bailout stenting for threatened acute closure, in which it is critical to cover the entirety of the dissected segment.

In present case, if we still believed empirical dissection on angiography and had not been alert to check IVUS after stenting, the mural hematoma would have progressed to compromise coronary flow and the worst result would have been acute closure of coronary flow threatening the patient’s life. Management between coronary dissection and mural hematoma is very different. The treatment of dissection is used appropriate-size stent and apposition to cover dissection, but the goal of mural hematoma is use of stent to keep patent lumen and maintain adequate coronary flow.

The other problem is that plaque burden had not been accurately evaluated when we chose the stent size. After high pressure balloon dilatation, the massive plaque burden had migrated to the proximal part and induced mural hematoma due to barotrauma. Mural hematoma in this case results from large amount of atheroma and treatment with high-pressure dilatation. Cross-sectional area stenosis of IVUS is distinct from diameter stenosis obtained by angiography because it does not use reference segments, unlike angiography. IVUS can more accurately evaluate plaque burden than angiography.

In conclusion, if there is massive atheroma detected by IVUS, the stent should be mildly undersized and appropriate pressure should be used to prevent plaque shifting and mural hematoma. In addition, if angiography reveals atypical dissection-like lesion, IVUS should be done to exclude mural hematoma. If mural hematoma has happened and coronary flow is normal, observation may be a good option. If a lesion is not well assessed before PCI, the result of angioplasty can be worse than with conservative treatment by medication.

REFERENCES