

Intravascular imaging of ruptured plaque by visual histology intravascular ultrasound in acute ST-elevation myocardial infarction

ST-yükselmeli miyokard infarktüsüne neden olan hassas plağın damar içi görüntüsel histolojili ultrasonografi ile görüntülenmesi

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Introduction

Acute ST-elevation myocardial infarction (AMI) results mostly from acute thrombotic occlusion of an epicardial coronary artery, typically after disruption or erosion of an atherosclerotic plaque and exposure of thrombogenic material to circulating blood. Acute coronary thrombosis, apart from serving as pathophysiologic basis for STEMI, forms the rationale for reperfusion therapy aiming at salvaging ischemic myocardium, improving left ventricular function and remodeling.

Intravascular ultrasound (IVUS) has provided significant insights into biologically mediated processes of the vasculature, such as the extent of plaque burden, vascular remodeling, and restenosis. Recent addition of virtual histology (VH) further enables us to analyze tissue characteristics of a plaque.

We present a case of ST-elevation myocardial infarction in a 49-year-old male where using both gray scale as well as VH, ruptured plaque was imaged and analyzed for its tissue composition.

Case Report

A 49-year-old male with no significant past medical history presented to the emergency room with a 4 hours of sudden onset substernal chest pain. A 12-lead electrocardiogram showed marked ST elevation in inferior leads. He was given 4 doses of 81 mg aspirin, started on IV unfractionated heparin as well as IV integrilin after loading with IV bolus doses of each drug. Patient was taken to the cardiac cat lab and selective coronary angiogram was performed. Left coronary angiogram revealed no significant disease. However, as expected, right coronary angiogram using 6Fr JR4 guiding catheter revealed complete occlusion of flow at its mid portion (Fig. 1).

Using a BMW (Balanced Middle Weight) guide wire, mid right coronary artery (RCA) lesion was successfully crossed and initially using an Export catheter™, mid RCA thrombus was aspirated before direct stenting. Aspirate revealed a large thrombus (Fig. 2). Later, mid RCA lesion was imaged using Volcano IVUS system, which showed a



Figure 1A. Right coronary artery occlusion

ruptured plaque with a deep ulceration in the vessel wall (Fig. 3A). Virtual histology analysis of the plaque confirmed the findings of vulnerable plaque with a large lipid core and a thin fibrous cap (Fig. 3B).

Mid RCA lesion was directly stented with a 3.5x18mm Xience™ drug-eluting stent with TIMI 3 flow and 0% residual stenosis.

Discussion

Rupture of a so-called vulnerable plaque with intraluminal clot formation is the basis for most of the acute coronary syndromes (1).

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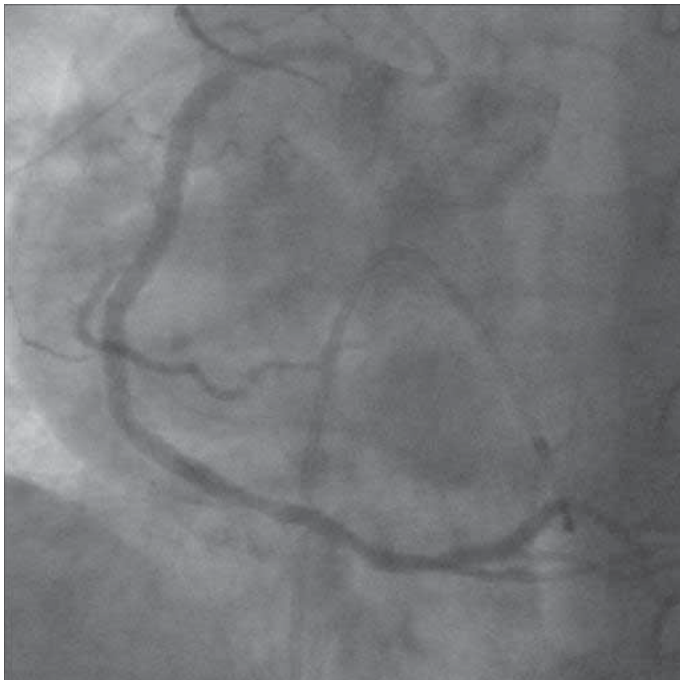


Figure 1B. Right coronary artery view poststenting

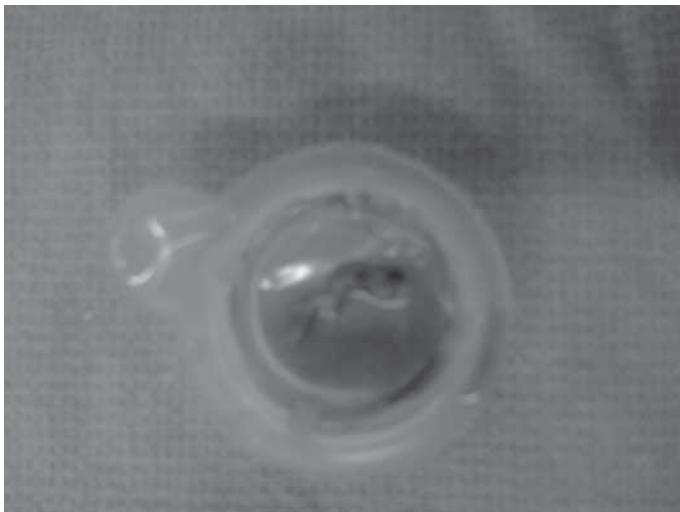


Figure 2. Aspirated thrombus

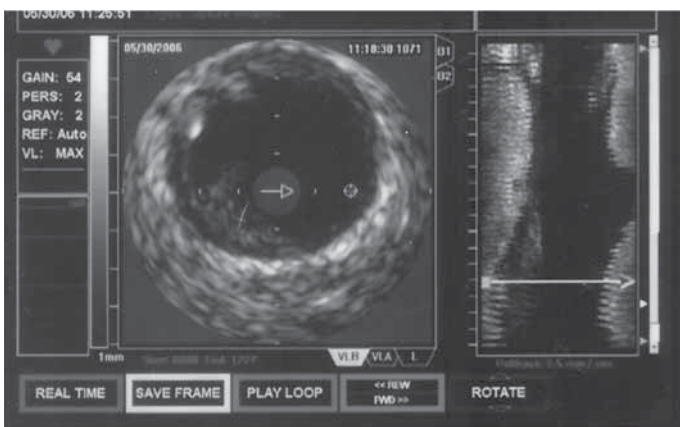


Figure 3A. IVUS grey scale
IVUS - intravascular ultrasound

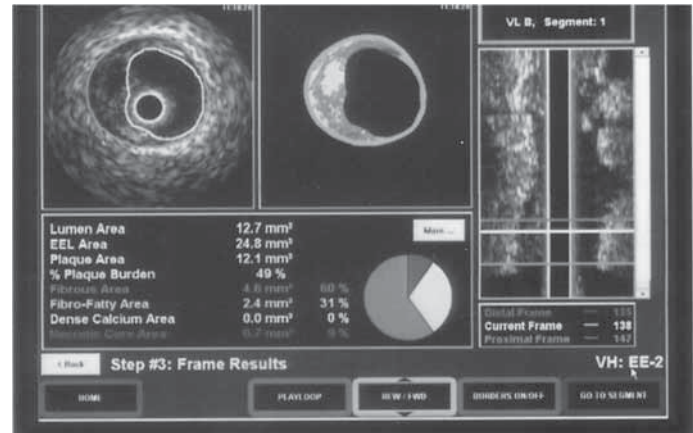


Figure 3B. IVUS virtual histology analysis

IVUS - intravascular ultrasound

Vulnerable plaque is characterized by a thin fibrous cap, large lipid core, and increased inflammatory cell penetration in the shoulder regions. Intravascular ultrasound is an imaging technique with a resolution of 100µm enables visualization of atherosclerotic plaque (2). In our patient, Gray scale IVUS imaging of mid RCA occlusion showed a ruptured plaque. Furthermore, with a new developing VH scale IVUS system, we were able to analyze the histologic components of the ruptured plaque with a large lipid core and a thin fibrous cap.

Percutaneous coronary intervention (PCI) for ST-elevation myocardial infarction can be complicated by spontaneous or angioplasty-induced embolization of atherothrombotic material. Distal blockage induces microvascular obstruction and can result in less than optimum reperfusion of viable myocardium. Recently published TAPAS study showed the significant benefit of thrombus aspiration using Export catheter in patients with STEMI prior to PCI (3). In this study, compared with conventional PCI, thrombus aspiration before stenting of the infarct-related artery showed to improve the 1-year clinical outcome (reduction in death, reinfarction) after PCI for ST-elevation myocardial infarction. In our patient, aspiration of thrombus with Export catheter showed a large clot burden.

Conclusion

Over the years, IVUS imaging of acute coronary syndrome patients led to further understanding and characterization of vulnerable plaque beside its use for proper stent size and assessment of complete stent apposition. Virtual histology analysis further enables us to characterize the tissue components of the plaque.

Compared to conventional PCI for STEMI, thrombus aspiration prior to stenting seems to lead to better clinical outcomes.

References

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