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EDITORIAL COMMENT

The Role of Intravascular Imaging in Coronary Thrombosis Assessment and Management*

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In this issue of *JACC: Case Reports*, Hage et al (1) used optical coherence tomography (OCT) to evaluate the mechanism of multiculprit vessel ST-segment elevation myocardial infarction (STEMI) with thrombotic occlusions present in both the left anterior descending (LAD) coronary artery and the right coronary artery (RCA). Proximal thrombus aspiration and distal catheter recanalization attempts were unsuccessful in improving the thrombus burden. Intensive antithrombotic therapy with aspirin, ticagrelor, enoxaparin, and tirofiban ultimately led to thrombus resolution. Importantly, repeated coronary angiography using OCT demonstrated plaque erosion in the proximal LAD and middle RCA with residual nonocclusive thrombus and a thickened intima. The patient was treated uneventfully with long-term dual antiplatelet therapy without percutaneous coronary intervention (PCI). The authors based their clinical decision on emerging data regarding potential differential treatment strategies based on intravascular imaging of coronary plaque characteristics.

The most common cause of coronary artery thrombosis in STEMI is plaque rupture, constituting approximately 75% of cases in large autopsy series. Plaque rupture generally occurs secondary to a tear in a thin cap fibroatheroma, exposing a necrotic lipid core and stimulating formation of a thrombus that obstructs coronary artery blood flow (2). Plaque erosion is the second most common cause of STEMI, with an incidence between 15% and 20% in postmortem studies (3). On histopathologic examination, plaque erosion differs from rupture in that there is no physical connection between the overlying thrombus and the lipid pool. The exposed intima is devoid of endothelial cells and consists primarily of smooth muscle cells and extracellular matrix. Plaque morphology demonstrates a thickened fibroatheromatous cap, a thickened intima, and an intact media (4,5). Plaque erosion can lead to either occlusive or nonocclusive thrombus.

The question whether plaque rupture versus erosion warrant different treatment strategies lies at the heart of the debate about the impact of intravascular imaging as an adjunct to conventional angiography on outcomes of acute coronary syndrome (ACS) and PCI (6). The ULTIMATE trial demonstrated improved outcomes with intravascular ultrasound (IVUS)-guided drug-eluting stent implantation; however, the benefit of routine intravascular imaging to guide PCI remains to be demonstrated (7). In a contemporary real-world analysis of Medicare patients undergoing PCI, a propensity matched analysis of patients who underwent IVUS-guided PCI showed lower 1-year mortality, myocardial infarction, and repeated revascularization rates compared with angiography-guided PCI (8). In the IVUS-XPL study, Hong et al (9) demonstrated that major adverse cardiovascular events were lower in IVUS-guided PCI than in angiography-guided PCI, primarily driven by lower rates of target lesion revascularization. The DOCTORS (Does Optical Coherence Tomography Optimize Results of Stenting) multicenter

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randomized control trial evaluating OCT-guided versus angiography-guided PCI in patients with non-STEMI showed that post-PCI fractional flow reserve was higher and final luminal stenosis was lower with OCT-guided PCI (10).

Several other studies and meta-analyses have demonstrated a critical additive role for OCT in coronary lesion analysis, ACS, and PCI. The prospective multicenter OCTAVIA (Optical Coherence Tomography Assessment of Gender Diversity in Primary Angioplasty) study demonstrated that plaque erosion with an intact fibrotic cap constituted approximately one third of index lesion plaque morphology. Erosion was associated with more frequent initial infarct artery patency, less residual luminal thrombus, and quantitatively smaller cardiac biomarker elevation (11). Prati et al (12) showed that a small series of patients presenting with STEMI secondary to plaque erosion identified by OCT after treatment with aspiration thrombectomy did well over long-term follow-up with pharmacotherapy without PCI. More recently, the single-center prospective EROSION (Effective Anti-Thrombotic Therapy Without Stenting: Intravascular Optical Coherence Tomography-Based Management in Plaque Erosion) study evaluated the feasibility of aspiration thrombectomy and pharmacotherapy without stenting in 60 patients with ACS secondary to plaque erosion (13). Forty-seven patients met the primary endpoint of >50% reduction of thrombus at 1 month, with 22 patients demonstrating complete resolution of thrombus. These studies have significant limitations, including small nonrandomized sample sizes, selection bias, and lack of validation of OCT against the histopathologic diagnosis of plaque erosion.

The role of intravascular imaging in identifying histopathologic plaque characteristics in ACS and STEMI may ultimately influence the indications for PCI, but definitive multicenter randomized trials are needed to prove this concept.

In this report, OCT elucidated the cause of ACS, dictated further management strategy, and obviated the need for long-term cardiac monitoring to exclude atrial fibrillation as a cause of multivessel coronary thrombosis. Cigarette smoking, as a significant risk factor underlying plaque erosion, rather than thrombophilia, was probably the inciting factor for STEMI in this patient.

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