

CARDIOVASCULAR FLASHLIGHT

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First-in-man assessment of plaque rupture by polarization-sensitive optical frequency domain imaging *in vivo*

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A 50-year-old man underwent primary percutaneous coronary intervention for anterior ST-segment elevation myocardial infarction 3 h after symptom onset. After thrombectomy, polarization-sensitive optical frequency domain imaging (PS-OFDI) was performed at the culprit left anterior descending artery lesion using a prototype imaging system (Wellman Center for Photomedicine). In addition to the conventional image of plaque structure, PS-OFDI provides a measure of tissue birefringence. This optical tissue property is elevated in tissue with regularly organized architecture, such as thick collagen fibres or smooth muscle cells.

Structure images showed a thin-cap fibroatheroma (TCFA) (Panel B1; arrow) with plaque rupture (Panel C1; white arrow) and thrombus (Panels C1–D1). Inspection of birefringence images revealed the presence of low birefringence (yellow colour) in the fibrous cap region both at the rupture site and proximally, suggesting the absence of thick collagen fibres (Panels B2–C2; white arrow). The intracoronary thrombus had predominantly low birefringence,

consistent with the unorganized architecture of acute thrombus (Panel D2), but also featured areas of intermediate-high birefringence, suggesting a higher degree of organization (Panel C2; black arrow). The lesion was then successfully treated with bioresorbable scaffold implantation.

Thrombotic coronary occlusion following plaque rupture is the most common pathomechanism of myocardial infarction. In our case, we witnessed an acute coronary syndrome, due to rupture of a TCFA, which presumably lacked thick collagen fibres in the fibrous cap. It is yet unknown how the collagen composition of the fibrous cap impacts plaque stability and whether thrombus healing impacts clinical event manifestation. Considering that invasive detection of TCFA predicts future culprit lesions poorly, a tool allowing an enhanced structural assessment such as PS-OFDI might improve invasive risk stratification in the future.

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