



HEALTHY HEART

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Honorary Editor :

Dr. Tejas V. Patel

Interventional Cardiologist



Dear Friends,

Optical coherence tomography (OCT) is an intracoronary imaging modality which utilizes near-infrared light to provide high-resolution cross-sectional in-vivo images of the coronary artery. OCT imaging technique enables detailed evaluation of plaque morphology in patients with acute coronary syndrome and helps to understand the underlying mechanisms including plaque rupture, plaque erosion, and calcified nodule. Coronary thrombosis is the most frequent final event leading to an acute coronary syndrome (ACS). The three most common underlying mechanisms contributing to ACS are believed to be plaque rupture (PR), plaque erosion, and calcified nodule.

ROLE OF INTRACORONARY IMAGING OCT IN ACUTE CORONARY SYNDROME

ACUTE CORONARY SYNDROMES

It is important to acknowledge the inherent weakness of coronary angiography to accurately assess vessel and lumen geometry, and its inability to evaluate plaque components and accurately detect the presence of thrombus—information more accurately provided by intravascular imaging. Where diagnostic or angiographic uncertainty exists in the setting of ACS, there is a role for intracoronary imaging to aid diagnosis and guide treatment (Figure 1).

Intracoronary imaging can delineate luminal discontinuity/plaque disruption and associated thrombus, the hallmarks of a culprit lesion. Optical coherence tomography provides accurate detection of intraluminal thrombus and is capable of distinguishing red and white thrombus due to the optical attenuating property of red blood cells, abundant within red thrombus.

LESION MORPHOLOGY IN ACS BY OCT

Rupture of a thin-cap fibroatheroma (TCFA) with associated thrombus formation has been the historical focus of attention in ACS and treatment has been tailored to stabilize this plaque type. However, pathology series and prospective studies conducted with intracoronary imaging demonstrated that one-third of all ACS and one-quarter of STEACS are caused by plaques with an intact fibrous cap — the majority identified as eroded plaques and a small cohort of calcific nodules. Intravascular imaging, in particular OCT, has enabled identification of these atherothrombotic features in patients presenting with ACS.

PLAQUE RUPTURE :

Plaque rupture is defined by discontinuity of the fibrous cap overlying a lipid-rich core. Ruptured fibrous cap-ACS is commonly associated with a vessel wall

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cavity, without IVUS or OCT signal, generated through downstream embolization of the necrotic core. Thrombi are often found overlying the ruptured segment. However, thrombus may be absent at the site of an old plaque rupture or with fresh rupture treated with anti-thrombotic/anti-coagulant therapies.

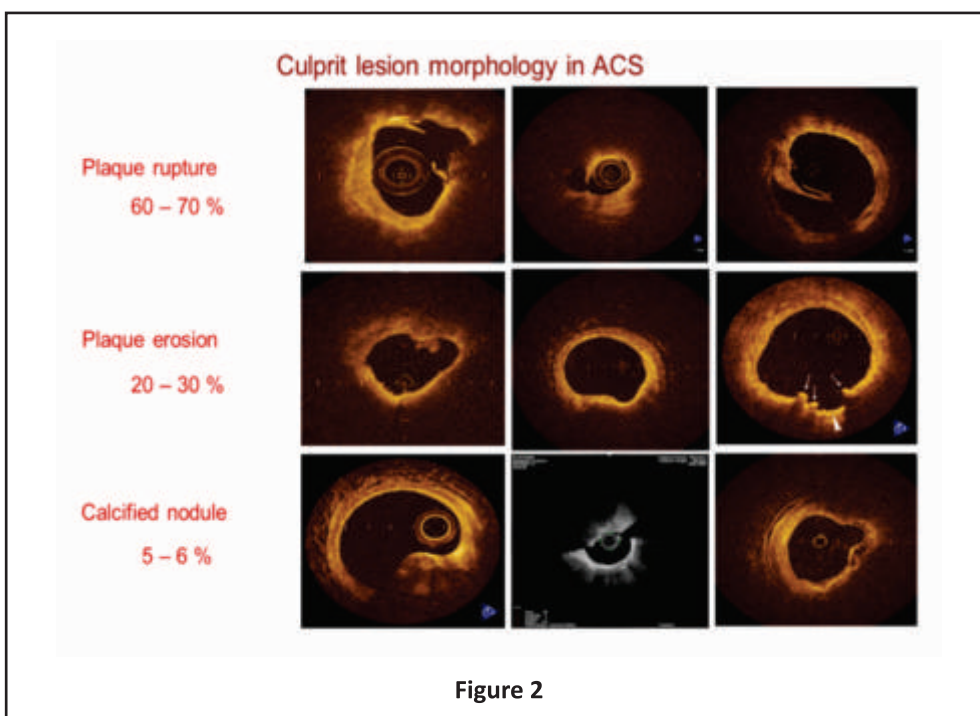
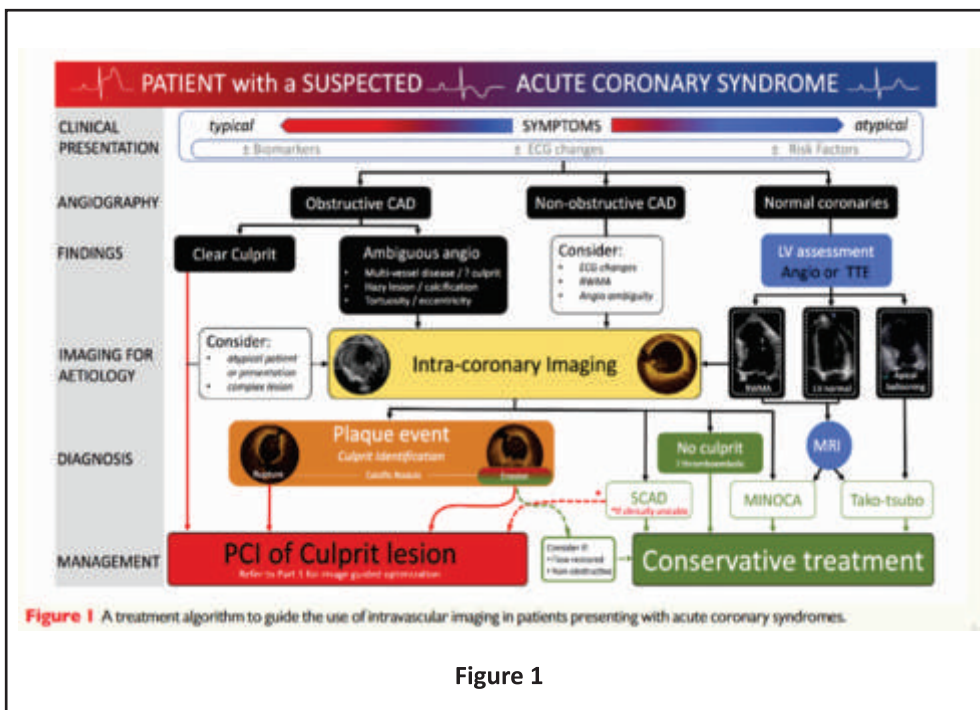
PLAQUE EROSION :

Plaque erosion is characterized by endothelial denudation, a poorly understood pathological process occurring at a level that is undetectable by current intracoronary imaging modalities. Only OCT has been successfully used, in clinical practice, to identify plaque erosion, although the diagnosis is one of exclusion, where thrombus is associated with non-disrupted plaque. An OCT diagnosis of plaque erosion is considered 'definite' in the absence of fibrous cap disruption, in a lesion frequently composed of fibrous tissue, with overlying luminal white thrombus.

ERUPTIVE CALCIFIC NODULE :

Discrete calcific nodule with associated plaque disruption is the least frequently observed substrate for ACS but can pose significant challenges for stent deployment and optimization. The lesions exhibit breaks in a calcified plate that disrupt the fibrous cap and are overlaid by thrombus. Imaging of erupted calcific nodule is possible with IVUS and OCT, with OCT providing superior detection of thrombus, delineation of superficial and deep boundaries of calcium and plaque disruption.

ROLE OF IMAGING IN VULNERABLE PLAQUE DETECTION AND RISK



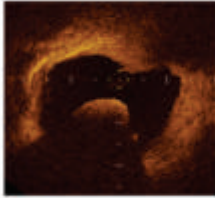
STRATIFICATION :

- IVUS-defined plaque burden >60–70% is predictive of subsequent MACE.
- Lipid-rich plaque (LCBI4mm > 400) is a predictor of plaque vulnerability and associated with a higher incidence of MACE.
- OCT and IVUS derived plaque characteristics enable identification of high-risk patients.
- Invasive plaque characterization provides superior positive predictive value of future events than CTCA.
- Identification of presumable high-risk



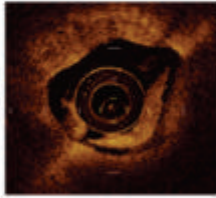
Red & white thrombus

Red thrombus



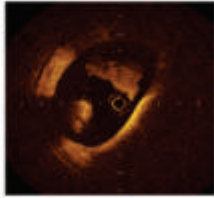
Protrusion mass with shadow

White thrombus



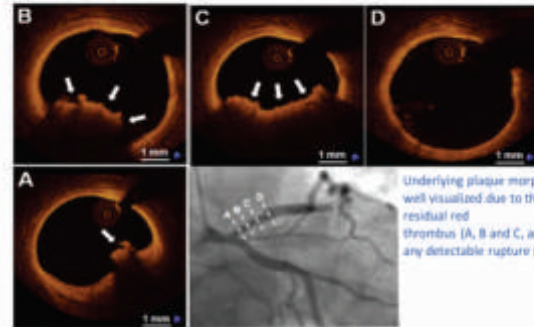
Protrusion mass without shadow

Mixed thrombus



Protrusion mass with & without shadow

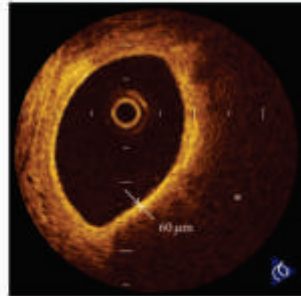
Representative case of OCT-erosion



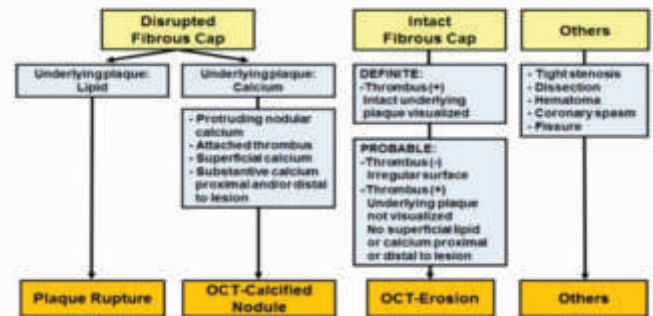
Underlying plaque morphology is not well visualized due to the presence of residual red thrombus (A, B and C, arrows) without any detectable rupture (A through D).

OCT: Thin-cap fibroatheroma (TCFA)

- TCFA is defined as a presence of thin fibrous cap ($<65\mu\text{m}$) overlying a lipid-rich plaque ($>90^\circ$)



Plaque Classification Algorithm in ACS by OCT



plaque characteristics using IVUS, OCT, or NIRS-IVUS can be considered to identify high-risk patients who would benefit from an increased intensity of risk factor modification and emerging therapies targeting atherosclerosis. Prospective validation of this strategy requires confirmation.

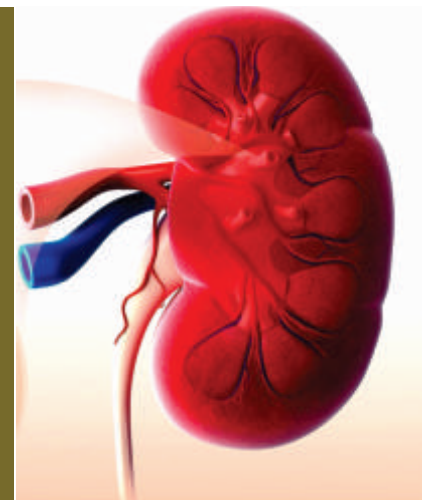
Angiographic interpretation in patients with non-STEACS (NSTEMACS) poses greater challenges due to the heterogeneity of presentation. An identifiable culprit lesion may be absent in $>30\%$ of patients and $>10\%$ of patients may have multiple culprit lesions on angiography. OCT is a promising modality for identifying underlying

pathology in patient presents with ACS. OCT-erosion is a frequent finding in patients with ACS, especially in those with NSTEMACS and younger patients.

25TH

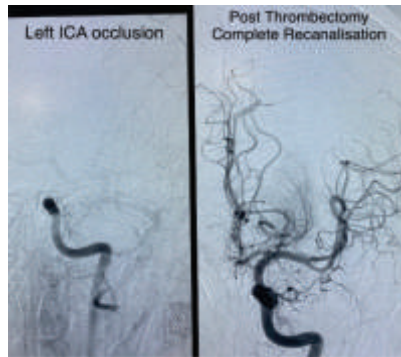
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Time is Brain and timely done intervention with well coordinated stroke team gives you best results.

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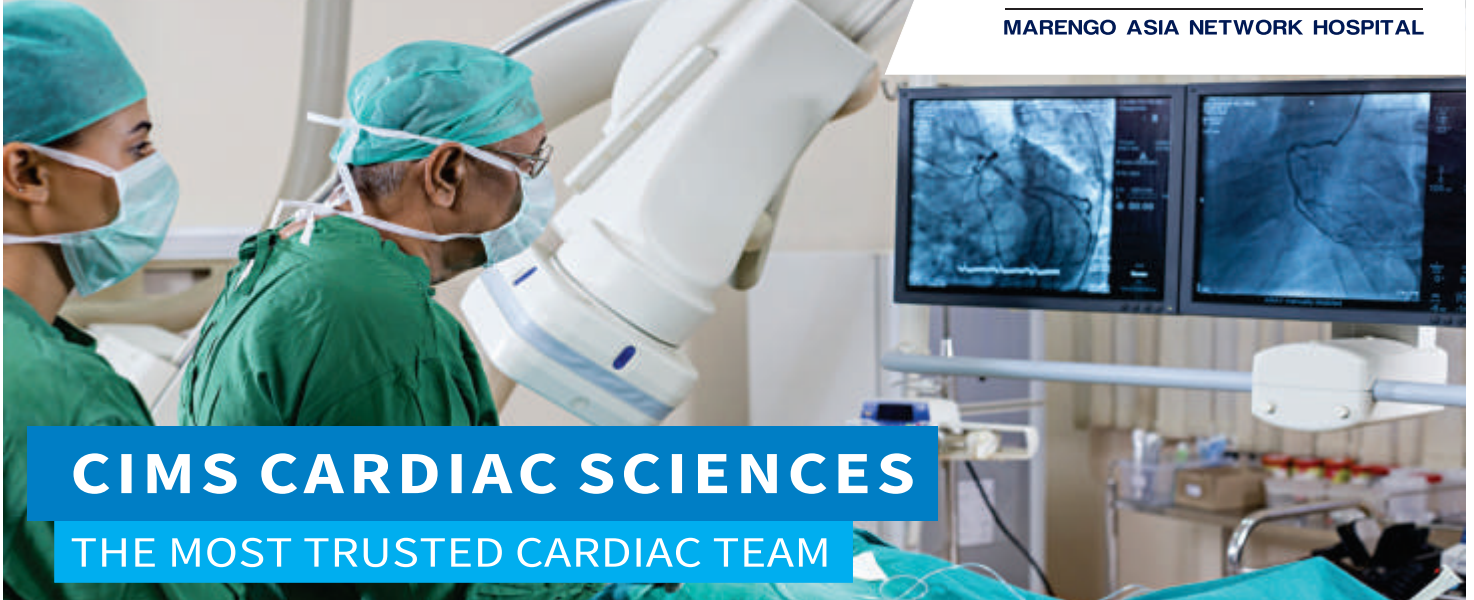
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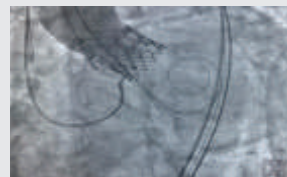
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