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(Citation)

European Heart Journal : Case Reports,6(1):ytab519

(Issue Date)

2022-01

(Resource Type)

journal article

(Version)

Version of Record

(Rights)

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<https://hdl.handle.net/20.500.14094/90008928>



Dark crescent sign: high-risk calcified coronary plaque detected by electrocardiogram-gated non-contrast computed tomography

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Received 15 September 2021; first decision 12 October 2021; accepted 3 December 2021; online publish-ahead-of-print 16 December 2021

A 71-year-old man with severe chronic kidney disease (CKD) presented with progressive angina. Coronary angiography revealed proximal left anterior descending artery stenosis (Figure 1A and B). Thereafter, electrocardiogram (ECG)-gated non-contrast 320-slice multi-detector computed tomography (CT) (Aquilion-one Vision, Canon Inc., Japan) prior to percutaneous coronary intervention (PCI) for evaluating coronary calcification in CKD settings showed a specific heavily calcified plaque (Figure 1C–E). Intravascular ultrasound (IVUS, AltaView®, Terumo, Japan) suggested the presence of an eccentric calcified atheroma, requiring atheroablation to optimal lesion preparation (Figure 1F). Low-speed and high-speed orbital atherectomy (OA) with backward advancement once each was performed for minimal debulking; however, no-flow phenomenon immediately occurred. IVUS post-OA showed no dissection and soft plaque behind the superficial calcification (Figure 1G). Despite repeated nitroglycerin administration, coronary flow delay did not fully improve, and ventricular fibrillation occurred. The patient was rescued by extracorporeal cardiopulmonary resuscitation and subsequent PCI with drug-eluting stent implantation (Figure 1H–I). Post hoc analysis of ECG-gated non-contrast CT (0.3-mm thin-slice images) revealed that this calcification has a unique morphology comprising a low-density area surrounded by high-density crescent signals (dark crescent sign), suggesting the possibility of calcified vulnerable atheroma (Figure 1E–H).

Although IVUS has limited ability to discriminate overall plaque beyond severe superficial calcifications due to acoustic shadows and reverberation in some cases, ECG-gated non-contrast CT might detect calcified characteristics.¹ Coronary calcium density on non-contrast CT can reflect coronary plaque stability. High-density severely calcified lesions have lower lipid content.² Calcified plaques with the dark

crescent sign may comprise soft plaques containing necrotic cores encapsulated by superficial calcification, for which OA can easily lead to the no-flow phenomenon. In addition to IVUS evaluation, ECG-gated non-contrast CT prior to PCI is useful for evaluating high-risk calcified plaques in patients with CKD. PCI with atherectomy devices under mechanical circulatory supports including intra-aortic balloon pumping or Impella may effectively prevent serious complications in such settings.³

Consent: The authors confirm that written informed consent for the publication of this case report was obtained from the patient in line with Committee on Publication Ethics (COPE) guidelines.

Conflict of interest: None declared.

Funding: None declared.

Data availability

The data underlying this article are available in the article and in its online [supplementary material](#).

References

1. Takahashi Y, Toba T, Otake H, Fukuyama Y, Nakano S, Matsuoka Y et al. Feasibility of morphological assessment of coronary artery calcification with electrocardiography-gated non-contrast computed tomography: a comparative study with optical coherence tomography. *Int J Cardiovasc Imaging* 2021;**37**: 1445–1453.
2. Criqui MH, Denenberg JO, Ix JH, McClelland RL, Wassel CL, Rifkin DE et al. Calcium density of coronary artery plaque and risk of incident cardiovascular events. *JAMA* 2014;**311**:271–278.
3. Aurigemma C, Burzotta F, Chieffo A, Briguori C, Piva T, De Marco F, Investigators et al. Clinical impact of revascularization extent in patients undergoing Impella-protected PCI enrolled in a nationwide registry. *JACC Cardiovasc Interv* 2021;**14**: 717–719.

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Handling Editor: Luca Arcari

Peer-reviewers: A Shaheer Ahmed; Jan Henzel and Livia Gheorge

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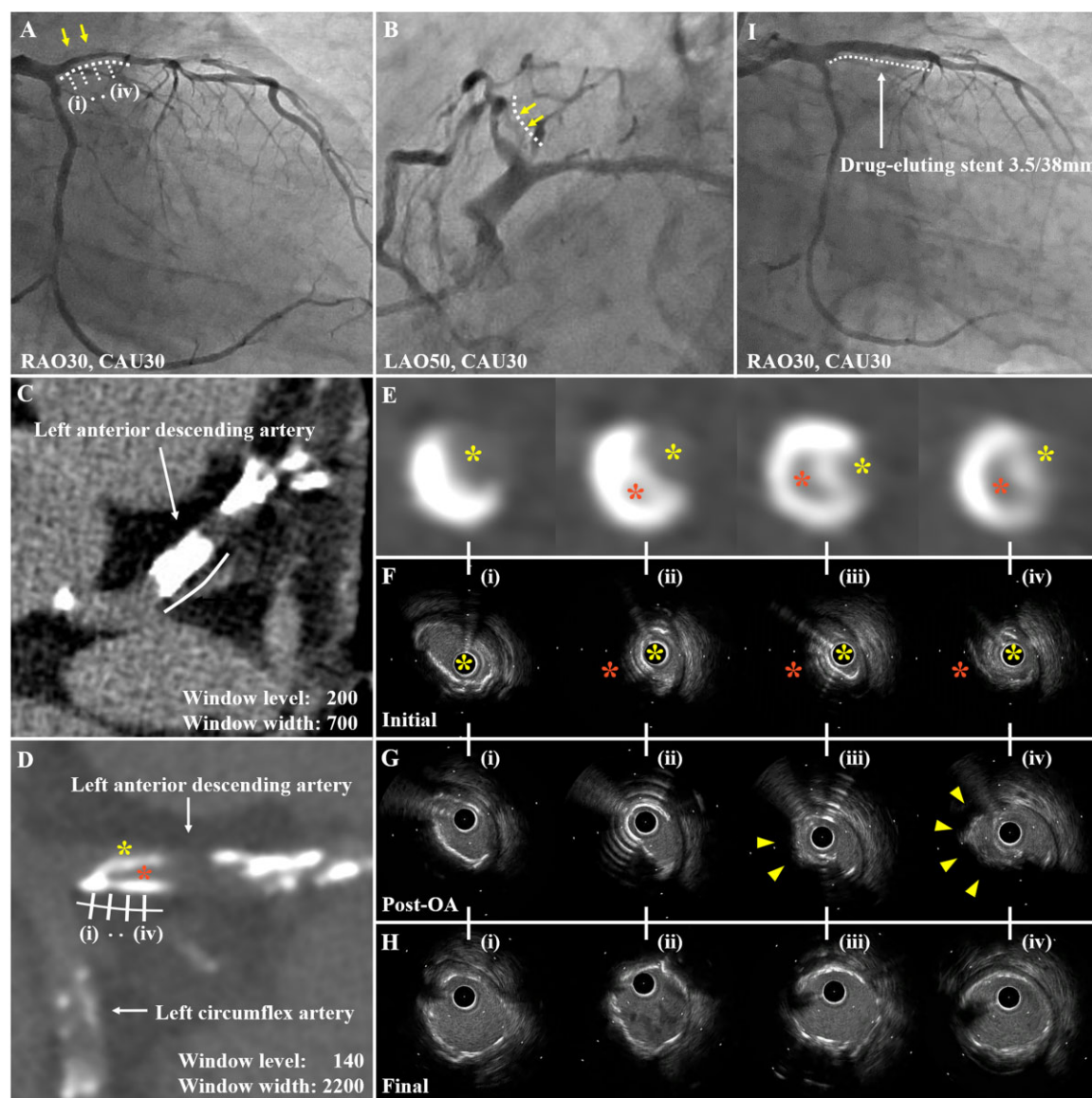


Figure 1 (A, B) Initial coronary angiograms showed calcified stenosis of the proximal left anterior descending artery. Yellow arrows indicate calcification. (C) Electrocardiogram-gated non-contrast computed tomography revealed a heavily calcified plaque of the proximal left anterior descending artery. (D) Curved multi-planar reconstruction image on electrocardiogram-gated non-contrast computed tomography revealed that the calcified plaque contained a low-density area surrounded by high-density signals. (E) Each cross-sectional image of the left anterior descending artery stenosis (i–iv) on electrocardiogram-gated non-contrast computed tomography. Yellow and orange asterisks indicate lumen and plaque, respectively. (F–H) Each cross-sectional image on intravascular ultrasound in accordance with computed tomography images; (F) initial, (G) post-orbital atherectomy, and (H) final. Yellow arrowheads indicate newly developed cavities with unmasked lipid components behind superficial calcification, suggestive of the main cause of distal embolization. A drug-eluting stent implanted in the left anterior descending artery is well-expanded. (I) Final coronary angiogram.