

IMAGES IN INTERVENTION

Different Findings in a Calcified Nodule Between Histology and Intravascular Imaging Such as Intravascular Ultrasound, Optical Coherence Tomography, and Coronary Angioscopy



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An 89-year-old woman who suffered a stroke and congestive heart failure was admitted to our hospital. She died of heart failure and autopsy was performed. Coronary arteries were removed from the heart and used for ex vivo imaging of intravascular ultrasound (IVUS; Atlantis, Boston Scientific Corporation, Natick, Massachusetts), optical coherence tomography (LightLab imaging Inc., Westford, Massachusetts), and coronary angioscopy (FiberTech, Tokyo, Japan) within 6 h after death

before fixation with 10% buffered formalin. IVUS illustrated a convex lesion with superficial hyperechoic signal accompanied by acoustic shadowing at the left anterior descending artery (Fig. 1A, arrows). Optical coherence tomography demonstrated an irregular surfaced high-backscattering protruding mass with signal attenuation (Fig. 1B, arrows, [Online Video 1](#)) and coronary angioscopy illustrated reddish polypoid lesion (Fig. 1C, arrows). Gross appearance showed convex mass with irregular surface (Fig. 1D,

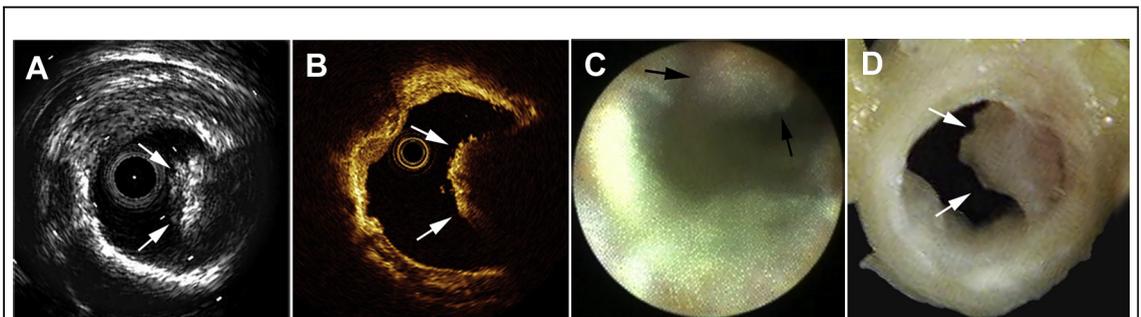


FIGURE 1 Ex Vivo Intravascular Images and Gross Pathology of the Calcified Nodule

Intravascular ultrasound showed convex lesion with superficial hyperechoic signal accompanied by acoustic shadowing (A, arrows). Optical coherence tomography demonstrated a high-backscattering protruding mass with signal attenuation (B, arrows, [Online Video 1](#)). Both modalities illustrated irregular luminal surface. Coronary angioscopy indicated reddish polypoid lesion into the vessel lumen (C, arrows). Gross appearance of transverse section of the nodule showed convex mass with irregular luminal surface in the intima (D), which was comparable to the findings of intravascular ultrasound and optical coherence tomography.

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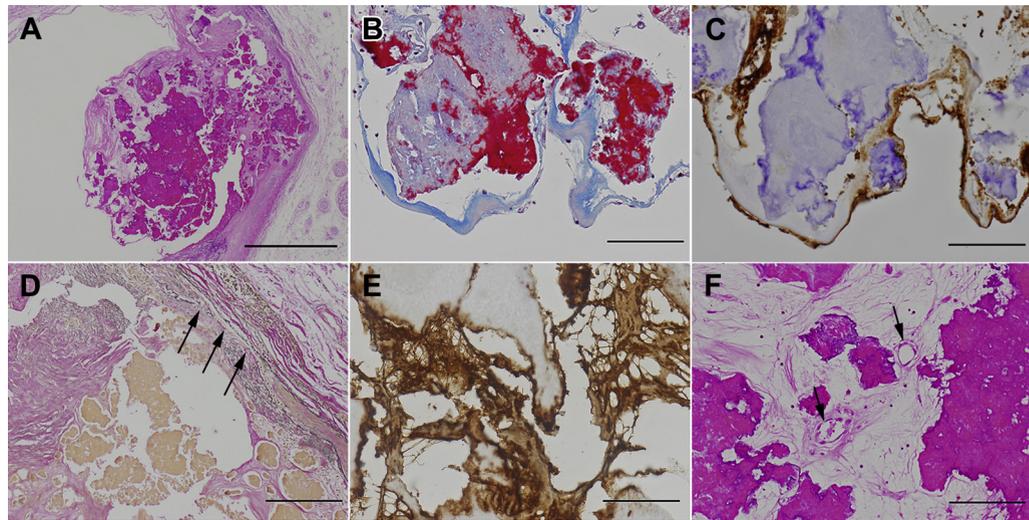


FIGURE 2 Histopathology of Calcified Nodule

Nodular calcification in the intima was observed by hematoxylin and eosin staining (**A**); **bar** = 1 μ m. Masson trichrome staining indicated extremely thin fibrous cap (**blue**) over the nodule and fibrin deposition (**red**) within the nodule (**B**); **bar** = 100 μ m. Complete endothelial cell coverage over the nodule was clearly shown by CD31 (DAKO, Glostrup, Denmark) immunohistochemistry (**C**); **bar** = 100 μ m. Calcified tissue penetrated into the media and part of the media was scarcely detected beneath the nodule by Elastic van Gieson staining (**D**, **arrows**); **bar** = 200 μ m. Immunohistochemistry for antifibrin IIb chain antibody (Accurate Chemical and Scientific Corporation, Westbury, New York) revealed the presence of fibrin meshwork within the nodule (**E**); **bar** = 50 μ m. Neovascularization was observed within the loose extracellular matrix beside calcification within the nodule (**F**, **arrows**); **bar** = 100 μ m.

arrows). Histopathology revealed nodular calcification without any mural thrombi (**Fig. 2A**). The fibrous cap over the nodule became extremely thin and fibrin deposition within the nodule was identified (**Fig. 2B**). Immunohistochemistry revealed complete endothelial cell coverage over the nodule (**Fig. 2C**). Part of the media was scarcely detected (**Fig. 2D**, arrows), and fibrin meshwork within the nodule was identified (**Fig. 2E**). Neovascularization within myxomatous matrix was observed (**Fig. 2F**, arrows) beside calcification.

It has been demonstrated that a calcified nodule has the potential to develop coronary thrombosis (1,2). In this study, intravascular images suggested mural red thrombi over the nodule. Although gross appearance was comparable to the findings of imaging modalities, histopathology revealed endothelial coverage over the nodule without thrombi. It is worth noting that the

pathology is strikingly different between a calcified nodule and a non-nodular calcification. The etiology of a calcified nodule is unknown, but it may be associated with ancient intraplaque hemorrhage and/or healed plaque rupture (3,4). We should pay heed to the interpretation of intravascular images for thrombus formation over the calcified nodule.

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REFERENCES

1. Virmani R, Kolodgie FD, Burke AP, Farb A, Schwartz SM. Lessons from sudden coronary death: a comprehensive morphological classification scheme for atherosclerotic lesions. *Arterioscler Thromb Vasc Biol* 2000;20:1262-75.
2. Karanasos A, Ligthart JM, Witberg KT, Regar E. Calcified nodules: an underrated mechanism of coronary thrombosis? *J Am Coll Cardiol Img* 2012; 5:1071-2.
3. Virmani R, Burke AP, Farb A, Kolodgie FD. Pathology of the vulnerable plaque. *J Am Coll Cardiol* 2006;47 Suppl 8:C13-8.
4. Burke AP, Weber DK, Kolodgie FD, Farb A, Taylor AJ, Virmani R. Pathophysiology of calcium deposition in coronary arteries. *Herz* 2001;26:239-44.

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APPENDIX For the supplemental video, please see the online version of this article.