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Post-Radiation Vasculopathy Causing Pseudoanomalous Coronary Artery

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Clinical History

A 48-year old male with a history of early childhood Hodgkin's lymphoma treated with mantle field radiation therapy presented with a late-peaking systolic murmur, chest pressure and worsening dyspnea. Echocardiography revealed severe aortic stenosis (AS) with a mean transaortic gradient of 61mmHg and extensive left ventricular outflow tract (LVOT) calcifications and underdevelopment. For anatomic reasons he was found not to be an appropriate surgical or transcatheter aortic valve replacement candidate. Thus he underwent workup for potential apico-aortic conduit surgery including coronary angiography. He was found to have significant ostial left and right coronary artery stenosis and underwent percutaneous coronary intervention and stenting. Returning a few months later for definitive surgery he reported of recurrent anginal symptoms and therefore had repeat coronary angiography.

Findings

Diagnostic invasive coronary angiography proved difficult, and selective engagement of the right coronary artery (RCA) was unsuccessful despite multiple attempts. A nonselective injection revealed opacification of the RCA from the left side of the aortic root, raising the possibility of an anomalous coronary artery.

Coronary CTA was then requested which demonstrated angulation of the proximal RCA and ostial RCA stent by dense bulky calcification within the right sinus of Valsalva. The sinus of Valsalva contained a channel between the calcifications and aortic cusp which mimicked the appearance of the anomalous coronary on nonselective invasive coronary angiography. There was also evidence of in-stent restenosis. The aortic root as well as the proximal pulmonary artery were severely calcified and narrowed (i.e. "porcelain changes") consistent with radiotherapy changes.

Discussion

Coronary artery disease (CAD) typically occurs 10 to 15 years after radiation therapy in patients treated with doses exceeding 30 Gray before the age of 20.[1] Radiation-induced stenosis generally affects the ostia and proximal coronary arteries, which lie within the anatomic radiotherapy field. Survivors of Hodgkin's disease bear a high relative risk for coronary artery disease[2] and coronary CTA is highly sensitive for the changes following thoracic radiation therapy, allowing early diagnosis of CAD.[3] Dense calcifications of the ascending aorta result from deposition of calcium due to intimal or medial scarring after radiation-induced aortitis.[1] Other radiation-associated complications include stenosis, occlusion or pseudoaneurysm of the great vessels, pericardial effusion, constrictive pericarditis, valvular disease, and myocardial fibrosis.

In this case, coronary CTA enabled accurate depiction of the atypical calcification of the aortic lumen, the stented origin of the RCA, and assessment of the suspected in-stent restenosis. The RCA restenosis was treated by repeat percutaneous coronary intervention. Following, the patient had successful apico-aortic conduit surgery to relieve the aortic stenosis outflow obstruction. This approach avoided the potential morbidity and mortality associated with a full sternotomy in the setting of extensive radiation associated changes, as well as the risk of manipulation of the calcified LVOT and aortic root.

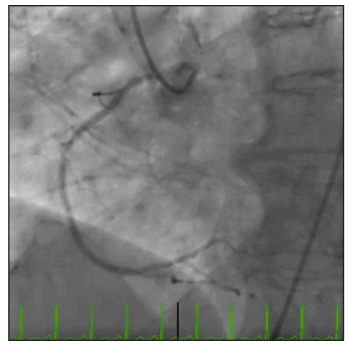

Figure 1

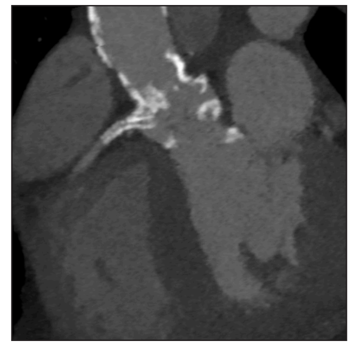

Figure 2

Figure 3

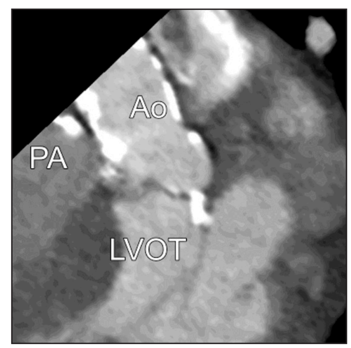

Figure 4

Figure 1: Invasive coronary angiography with nonselective aortic root injection demonstrated opacification of the right coronary artery from the left side of the aorta. The catheter tip is directed leftward in this view.

Figure 2: Multiplanar reconstruction through the ostial right coronary artery stent demonstrates dense, bulky calcifications that cause angulation of the stent. Intraluminal hypodensity is consistent with in-stent restenosis. High tube-potential dual-source 128-slice computed tomography was performed using thin-slice high-resolution images and advanced iterative reconstruction techniques to mitigate the effects of beam-hardening due to extensive calcium and metallic stents.

Figure 3: Curved multiplanar view in a plane orthogonal to figure 2 confirms dense, bulky calcifications resulting in a channel connecting the left and right sinuses of Valsalva. Opacification of the channel created the illusion of an anomalous coronary artery on nonselective invasive angiography.

Figure 4: Cine long-axis mulitplanar reconstruction through the left ventricular outflow tract (LVOT) demonstrates restricted motion of the sclerotic aortic valve leaflets, and marked calcification of the mitral-aortic continuity, the aortic root, ascending aorta (Ao), and pulmonary artery (PA). Calcification of the pulmonary artery is extremely rare, but resulted from inclusion of the pulmonary artery within the radiation field. Image noise during diastole is due to radiation dose reduction measures.

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