A 56-year-old woman was referred for investigation of worsening signs of heart failure. She had been treated with radiotherapy and chemotherapy for Hodgkin disease 19 years earlier. Because the patient had disease localized to the mediastinum, she had received mantle radiation, which is focused on the sternal area. She had also undergone MOPP chemotherapy (mechlorethamine, vincristine, procarbazine, and prednisone), an anthracycline-free regime. Eighteen months earlier, she had presented with exertional dyspnea. At that time, coronary angiography demonstrated ostial stenoses of the left and right coronary arteries (Figure, A and B; arrows), which were treated with percutaneous intervention and stenting. Repeat coronary angiography revealed that both stents were widely patent without any other significant coronary stenoses. Echocardiography revealed basal hypokinesis, an ejection fraction of 35%, and normal valvular function. Cardiac magnetic resonance imaging (CMR) was ordered to investigate the cause of her heart failure.

Figure. A and B, Initial coronary angiography demonstrating ostial stenoses of the right and left coronary arteries (arrows). C and D, Late inversion-recovery contrast-enhanced CMR images acquired 10 minutes after gadolinium injection in the 2-chamber (A) and short-axis (B) views demonstrate patchy basal fibrosis, not corresponding with a coronary territory.
CMR revealed a nondilated hypokinetic left ventricle with akinesis of the anterior, septal, and lateral walls of the basal left ventricle and akinesis of the basal right ventricle. The ejection fraction was confirmed at 35%, predominantly the result of the basal akinesis. There were no significant valvular lesions on MRI. There were pleural effusions and a moderate pericardial effusion (Movies 1 and 2) without any evidence of pericardial thickening or constrictive pericardial disease. Delayed enhancement images demonstrated basal myocardial fibrosis (Figure, C and D; arrows). This fibrosis did not correspond to a coronary territory or to a pattern consistent with other cardiomyopathies such as amyloidosis or sarcoidosis. There was no evidence of myocardial infarction. She was diagnosed with radiation-induced cardiomyopathy. Her medical treatment was optimized and she was discharged from hospital.

As oncology treatments improve with longer survival rates, radiation-induced heart disease is likely to be increasingly recognized. Mediastinal radiotherapy significantly increases the risks of myocardial infarction, angina pectoris, heart failure, and valvular disorders. The coronary ostia are typically affected. Radiation leads to microvascular insufficiency and ischemia, resulting in diffuse and patchy interstitial myocardial fibrosis. Myocardial fibrosis is usually seen at radiation doses above 30 Gy and is often asymptomatic. A number of studies using single-photon emission computed tomography have found significantly increased rates of perfusion defects in patients who have undergone mediastinal radiation compared with control subjects. These defects have correlated well with the irradiated areas of the left ventricle. Right ventricular abnormalities have not been described; however, single-photon emission computed tomography may not have the same sensitivity as CMR for assessing the right ventricle.

CMR patterns of delayed enhancement can help distinguish between the causes of cardiomyopathy, including ischemia, valvular, myocardial, and pericardial diseases. This information can be used before considering revascularization in patients with potential nonischemic causes of heart failure.

Sources of Funding
Dr O h-Icí received grant support from the Irish Board for Training in Cardiovascular Medicine, which was sponsored by BMS/Sanofi Aventis (Ireland).

Disclosures
None.

References

Key Words: cardiomyopathy ■ heart failure ■ myocardial fibrosis ■ radiation-induced heart disease
Radiation-Induced Heart Disease
Darach O h-Ící and Jérôme Garot

*Circ Heart Fail.* 2011;4:e1-e2
doi: 10.1161/CIRCHEARTFAILURE.110.958454
*Circulation: Heart Failure* is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2011 American Heart Association, Inc. All rights reserved.
Print ISSN: 1941-3289. Online ISSN: 1941-3297

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circheartfailure.ahajournals.org/content/4/1/e1

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in *Circulation: Heart Failure* can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to *Circulation: Heart Failure* is online at:
http://circheartfailure.ahajournals.org/subscriptions/