Case Report

Radiation-Induced Valvulopathy

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ABSTRACT

Cardiovascular disease and cancer are the 2 leading causes of morbidity and mortality in the world. Radiation to the mediastinum is a key component of treatment for numerous neoplasms, including Hodgkin's lymphoma and breast cancer. Improvements in oncological treatments have increased the number of survivors, some of whom may suffer from adverse cardiovascular effects due to radiation therapy. [1, 2]

The delayed detrimental cardiovascular effects of such radiotherapy protocols have been recognized more recently, largely due to the latency of presentation. [3] Because of the increased life expectancy of these patients, healthcare providers are witnessing an increasing number of long-term side effects of these treatments. Mediastinal radiotherapy is known to cause valvular disease, pericarditis, coronary artery disease, and cardiomyopathy. [4]

We herein describe a patient who developed radiation-induced valvulopathy with the typical presentation of radiation-induced heart disease 8 years after a left-sided mastectomy and receiving chemotherapy and radiotherapy for breast cancer. ***(Iranian Heart Journal 2022; 23(1): 228-232)***

KEYWORDS: Radiation-induced heart disease (RIHD), Breast cancer, Cancer treatment

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We herein describe a patient who developed radiation-induced valvulopathy (RIV) with the typical presentation of radiation-induced heart disease 8 years after a left-sided mastectomy and receiving chemotherapy and radiotherapy for breast cancer.

Case Report

A 61-year-old woman with a history of breast cancer, a left-sided mastectomy, chemotherapy, and radiotherapy presented with shortness of breath of 6 months' duration.

The patient's symptoms had gradually worsened to the extent that she could no longer walk 100 meters without becoming short of breath.

Eight years earlier, she had been diagnosed with breast ductal carcinoma, for which she received chemotherapy and radiotherapy after a left-sided mastectomy.

On physical examination, the patient had a blood pressure of 150/80 mm Hg, a heart rate of 95 bpm, a respiratory rate of 17 breaths per minute, and an oxygen saturation level of 98% on room air. Her body temperature was normal.

Cardiovascular examination revealed a grade III apical holosystolic murmur with radiation to the axilla, a loud holosystolic murmur at the left lower sternal border increasing in intensity with inspiration, and a grade III holodiastolic murmur.

Sings of alveolar edema with a normal cardiothoracic ratio were found in the chest radiogram.

Transthoracic and transesophageal echocardiographic examinations showed normal biatrial and biventricular size with mild left ventricular systolic dysfunction (ejection fraction =50%) and preserved right ventricular systolic function. Nonetheless, left ventricular diastolic function was significantly reduced (grade III).

There was also moderate mitral and aortic valve regurgitation, resulting from thickening and retraction and severe degenerative changes in the valve cuspids (Fig. 1, Fig. 2, Fig, 4 & Fig. 5).

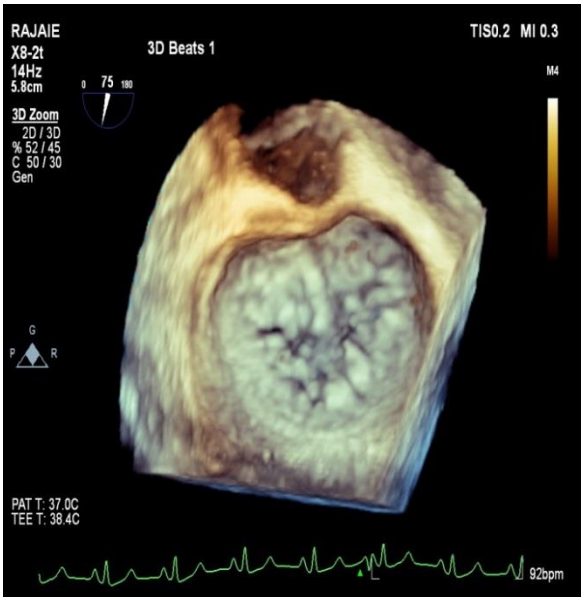

Figure 1. Mitral valve calcification and degenerative changes can be seen.

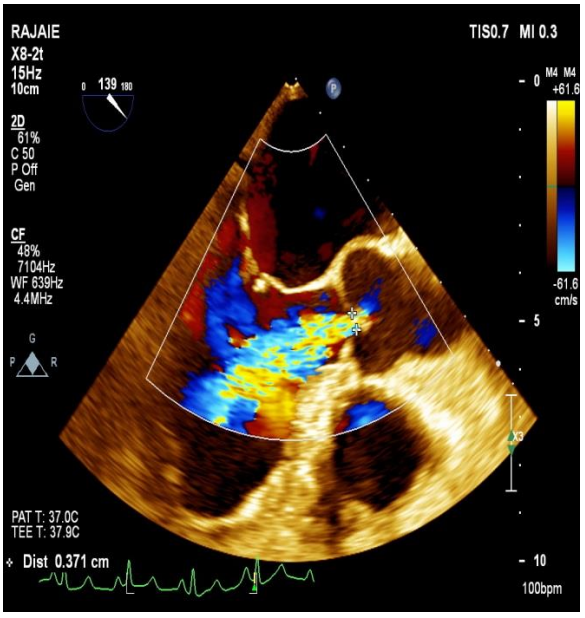

Figure 2. The image illustrates moderate aortic regurgitation and a normal-sized heart chamber in transesophageal echocardiography.

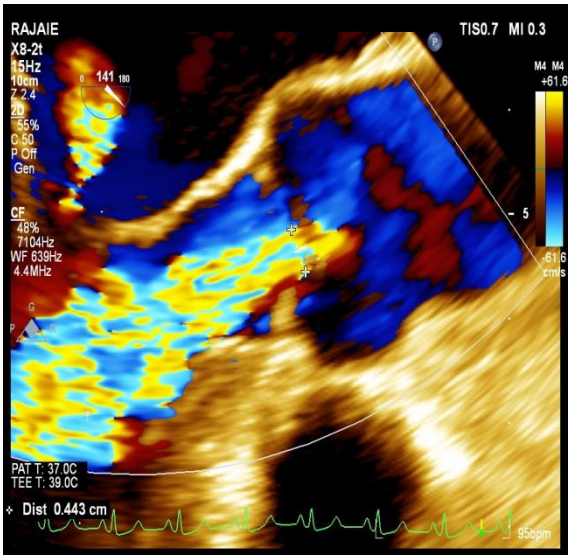

Figure 4. The image presents a zoomed view of aortic regurgitation in transesophageal echocardiography.

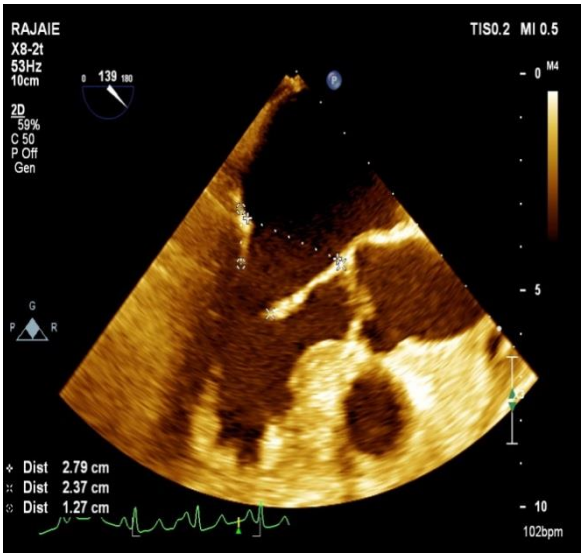

Figure 5. Transesophageal echocardiography view of the mitral and aortic valve is presented herein.

The tricuspid valve was normal in shape but with moderate-to-severe regurgitation. Right ventricular systolic pressure was estimated at 88 mm Hg (Fig. 3).

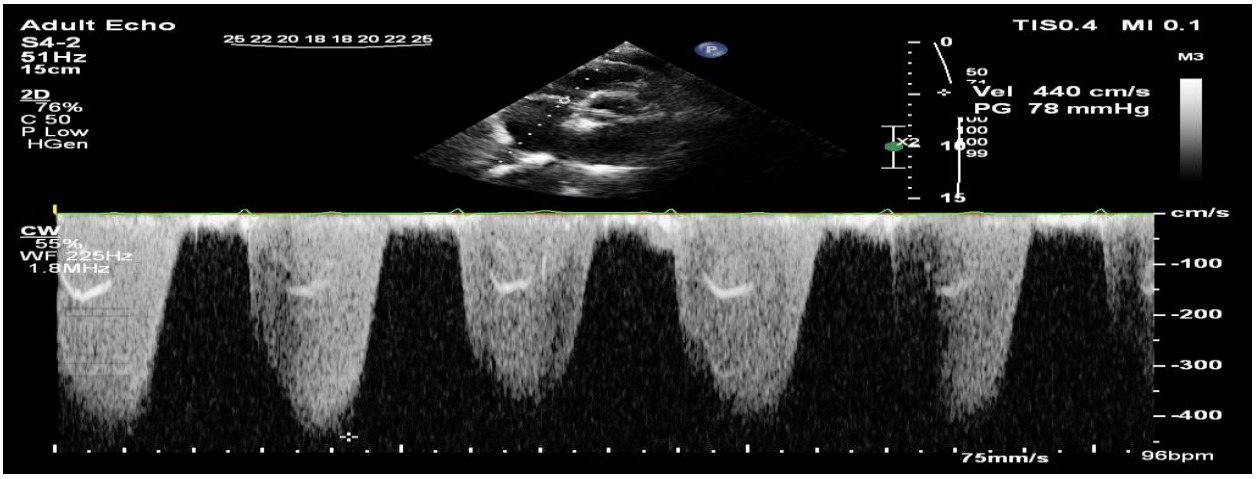

Figure 3. The image shows severe tricuspid regurgitation and severe pulmonary hypertension in our patient.

The pulmonary valve was mildly thickened with mild-to-moderate regurgitation. Additionally, there was a mild pericardial effusion around the left atrium without any hemodynamic effects. The inferior vena cava was top normal in size with decreased respirophasic changes.

After further evaluation, the diagnosis of RIV was established. The patient was administered diuretics, angiotensin-converting enzyme inhibitors, and beta-blockers.

DISCUSSION

As oncology treatment has improved, so has life expectancy. Therefore, RIV is likely to be increasing as well. However, the association between chest radiation and

valvular heart disease is often overlooked, and many general practitioners are not aware of it. [1,2,5]

Injury to the heart caused by radiation may appear as accelerated coronary artery atherosclerosis, typically involving the proximal coronary vessels, pericardial disease, myocardial systolic and diastolic dysfunction, and valve disease. [2]

Radiation-induced myocardial fibrosis can result in a broad spectrum of myocardial dysfunction cases, spanning the progressive stages of diastolic dysfunction to overt systolic heart failure. Biventricular radiation-associated fibrosis is diffuse and typically follows a nonischemic pattern. Nevertheless, concurrent radiation-induced coronary diseases can result in ischemia/infarction and coexistent regional fibrosis. The detrimental effects of radiation on myocardial function can be compounded by chemotherapeutic agents, particularly anthracycline and newer agents such as trastuzumab, which are frequently used before or after radiation therapy. [6]

Radiation therapy to the mediastinum can be associated with significant valvular abnormalities (typically involving the aortic and mitral valves). Such abnormalities usually manifest themselves as progressive valve thickening and calcification. They ultimately result in valve restriction and dysfunction, presenting as stenosis and/or regurgitation. Often, in addition to the valves, the surrounding structures such as the valve annulus, the subvalvular apparatus, and the aorto-mitral curtain (which extends from the base of the anterior mitral leaflet to the commissure between the non- and left coronary aortic valve cusps) are also frequently involved. [6] While acute pericarditis is now less common with modern radiation protocols, chronic pericarditis may manifest many years after treatment completion. Chronic pericardial inflammation can result in both parietal and visceral fibrosis and a thickened, rigid and often calcified pericardial sac with resultant constrictive pericarditis. [6]

Reports suggest that 42% of chest-irradiated patients have significant asymptomatic valvular diseases, and 14% have stress-induced myocardial ischemia, although the true incidence is likely higher due to under-recognition. [7-11] Typically, screening for coronary artery disease should commence within 5 years after radiation exposure, based upon the timing of major coronary events in breast cancer survivors. Due to its later presentation, screening for valvular heart disease is typically delayed until 10 years after radiotherapy, with subsequent imaging then performed at 5-year intervals. Echocardiography is the most common screening tool employed for the detection and monitoring of radiation-associated cardiac disease. The recommended frequency of echocardiographic screening varies according to the individual, but it is typically performed every 2 years in asymptomatic individuals and more often once symptomatic or clinically indicated. It remains to be noted that the presentation can be quite heterogeneous in individuals, and findings may not be observed in everyone. In addition to left ventricular ejection fraction, left ventricular strain assessment enables the further assessment of myocardial function and can be useful in distinguishing constrictive from restrictive cardiomyopathies. In asymptomatic or subclinical diseases, the left ventricular strain may be reduced, despite normal left ventricular ejection fraction. [6-8]

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