

Cardiac perfusion screening in patients to be treated with radiation therapy in the chest, is it a must?

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Radiation therapy has been used for treatment of cancer for a long time [1]. In the thoracic region, it is frequently used for management of Hodgkin and non-Hodgkin lymphoma, lung cancer, esophageal cancer, breast cancer, thymoma and other malignancies in the thorax. The management of these malignancies has undergone a major evolution during the last decades. The majority of cancer patients now undergo some form of combined radiation and chemotherapy. Initially the heart was thought to be relatively resistant to radiation induced injury but the lately the existence of radiation-induced heart disease has been established [2]. Due to the success of radiation and chemotherapy there is a growing cohort of survivors of cancers who are at risk for the complications of radiation therapy of the chest. These complications include arm edema, pneumonitis, rib fractures, brachial plexopathy, secondary malignancies and cardiac toxicity. Unfortunately, radiation can damage any component of the heart. Pericarditis is a typical early complication, with dense collagen and fibrin replacement of the adipose tissue. Also coronary artery disease, cardiomyopathy,

valvular heart disease and conduction abnormalities can occur years after radiation treatment [3]. The histologic findings of radiation induced cardiotoxicity are diffuse interstitial fibrosis and narrowing of arterial vessels and capillaries [4]. There is a 50% reduction of the ratio of capillaries to myocytes which in turn results in myocardial cell death, ischemia and fibrosis. Radiation also causes injury of the coronary artery endothelial cells. It causes fibro-intimal hyperplasia, which in turn leads to thrombus formation and lipid deposition [5]. In some cases coronary spasm may occur [6].

Radiation therapy ultimately can result in coronary artery disease, fibrotic changes of cardiac leaflets or valves, diastolic function and cardiac arrhythmias [7–11]. Risk factors for radiation induced cardiac toxicity are total radiation dose, radiation dose per fraction, the volume of the heart exposed to radiation and the concomitant administration of cardiotoxic chemotherapy like anthracyclines and trastuzumab. The paper of Gayed et al. in the present issue of the International Journal of Cardiac Imaging addresses an important clinical issue of patients who survived esophageal and lung cancer [12]. The authors show that one-third of the patients who received radiation therapy with the heart in the radiation field developed cardiac ischemia. Even more patients developed cardiac complications and cardiac death. Although cardiac ischemia was frequently seen, it was not predictive for future cardiac complications. In a multivariate analysis, a history or the presence of

Editorial comment to the article of Gayed et al. (doi: 10.1007/s10554-009-9440-7).

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arrhythmias and a history of congestive heart failure was associated with cardiac complications. Most of the patients with cardiac ischemia did not have anginal complaints. These findings are in agreement with the study of Marks et al. [9], Heidenreich et al. [13, 14] and the Dutch Late Effects Breast Cancer Cohort, which studied the effects of cardiovascular toxicity of radiation therapy in women with breast cancer during a period of 10 years [15, 16] and the SEER database [17]. The latter was a large study of women, who survived breast cancer treated with radiation therapy. It showed, that after irradiation the risk of myocardial infarction, angina pectoris and heart failure was increased compared to the women without breast cancer.

The sample size in the study of Gayed was too small and the follow-up time too limited to draw conclusions if silent ischemia detected on myocardial perfusion imaging was predictive for cardiovascular events in this patient population. However, studies in patients with coronary artery disease have shown adverse outcome related to the episodes of asymptomatic cardiac ischemia [18]. In a retrospective review of patients treated with radiation therapy for Hodgkin's disease a relative risk for fatal myocardial infarction of 41.5 over the age-matched general population was shown. Death frequently occurred long (3–22 years) after exposition to radiation [19].

Doctors who take care of patients with cancer who have to be treated or have been treated with radiotherapy of the chest should be aware of the cardiac risks of irradiation. The clinical implication of myocardial perfusion imaging in this group of patients has to be established in large trials with a long follow-up of at least 5–10 years.

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