Radiotherapy effects on systolic myocardial function detected by strain rate imaging in a left-breast cancer patient

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Forty-eight-year old woman with left-sided mastectomy due to breast cancer received radiotherapy (RT) to the chest wall by a direct electron field. The internal mammary and medial supraclavicular lymph nodes were also irradiated with an anterior mixed photon-electron field. The radiation field was planned using a patient-specific treatment planning computed tomography (CT). Radiation dose was 50 Gy in 25 fractions.

Radiation effect on cardiac function was assessed by conventional echocardiography and strain rate imaging (SRI), obtained before and 2 months after RT.

Conventional echocardiography parameters (LV dimensions, ejection fraction, fractional shortening) remained normal during follow-up. SRI, however, showed a decrease in regional function related to the radiation dose distribution.

Panel A shows a three-dimensional (3D) CT reconstruction of the patient’s heart. The surface of the LV was colour-coded according to radiation dose distribution.

Panel B shows the underlying treatment planning CT data set (cardiac three-chamber view with radiation dose iso-lines; same colour scale as Panel A).

Panel C shows a 3D model of the LV displaying the colour-coded change in regional function (absolute decrease in peak longitudinal systolic strain at 2 months after RT vs. baseline). Note the matching patterns of radiation dose distribution and myocardial function decrease.

Panel D exemplifies the change in end-systolic longitudinal strain (red arrow) in the anteroapical segmental strain (solid line, before RT; dashed line, after RT; AVO; AVC; MVO; MVC, aortic and mitral valve opening and closure).

Part of the heart is often included in the RT fields used in left-breast cancer. Radiation dose and the cardiac volume included in the RT field correlate with long-term cardiovascular mortality. Little is known about the early effects of radiation on myocardial function. Our case shows for the first time that SRI is superior to conventional echocardiography in detecting RT-related early changes in myocardial function.

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