

Cyclic variation of integrated backscatter detects radiotherapy-induced changes better than global longitudinal strain, a three-year follow-up study in early-stage breast cancer patients

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Aims: To characterize the early phases of radiotherapy-induced changes in myocardial deformation echocardiography.

Methods: Ninety-nine breast cancer patients were studied prior adjuvant treatment, after chemotherapy (CT), after radiotherapy (RT) and three years after RT (3Y). Nineteen patients with left-sided breast cancer received adjuvant CT and RT (Group A). Sixty patients with left-sided (Group B) and 20 patients with right-sided breast cancer (Group C) were treated with RT only. Echocardiography with the analysis of cyclic variation of the integrated backscatter of the septum (sCV) and the posterior wall (pCV) and global longitudinal strain (GLS) were performed.

Results: Group A patients had a sCV decline from baseline to after CT, after RT and at 3Y by 1.2 ± 3.4 dB ($p = 0.146$), 2.6 ± 3.9 dB ($p = 0.010$) and 4.1 ± 5.4 dB ($p = 0.011$), and GLS decline by 0.9 ± 1.7 % ($p = 0.027$), 0.1 ± 2.4 % ($p = 0.848$), and 0.9 ± 2.9 % ($p = 0.124$), respectively. Group B displayed sCV changes after RT by 1.4 ± 3.5 dB ($p = 0.007$) and at 3Y by 2.4 ± 3.2 dB ($p < 0.001$) and the respective GLS changes were 1.1 ± 2.7 % ($p = 0.003$) and 1.7 ± 3.5 % ($p = 0.001$). sCV changes in Group C were 1.3 ± 3.9 dB ($p = 0.159$) after RT and 2.0 ± 4.1 dB ($p = 0.049$) at 3Y whereas GLS remained stable. A late decline in pCV was observed in all groups. In the whole patient population, sCV decline was independently associated with the mean LAD dose ($p = 0.023$, $\beta = -0.251$), CT ($p = 0.044$, $\beta = -0.240$) and with the use of aromatase inhibitor (AI) ($p = 0.027$, $\beta = 0.251$). GLS impairment was independently associated with AI ($p = 0.017$, $\beta = -0.281$).

Conclusions: Radiation-exposed septal areas displayed a significant decline early after RT in Group A and B patients in contrast to posterior wall and patients with right-sided breast cancer. In addition, the changes were independently associated with the mean LAD radiation dose. GLS had no independent association with radiation dose. CV appears to be a more sensitive marker of radiotherapy-induced changes of the myocardial contractility than GLS.