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Cardiotoxicity Associated with Antineoplastic Therapy: A Multidisciplinary Approach to Personalized Monitoring Using Radionuclide Imaging and Molecular Biomarkers

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Abstract

Background: Cardiotoxicity associated with antineoplastic therapy may compromise both cardiovascular outcomes and continuity of cancer treatment. We evaluated a multimodal strategy based on radionuclide imaging and molecular biomarkers for early detection of subclinical cardiac dysfunction and for personalized monitoring applicable in multidisciplinary oncologic care.

Methodology: In this prospective, observational, single-center study, 90 adults with breast cancer, lymphoma, or lung cancer receiving potentially cardiotoxic regimens were evaluated at baseline (T0), after 3-4 cycles (T1), at treatment completion (T2), and at 6-month follow-up (T3). Antineoplastic exposure was classified according to dominant cardiotoxic profile, including anthracycline-containing regimens, anti-HER2 therapy, platinum/taxane-based chemotherapy, immunotherapy, and targeted agents when used. Monitoring included clinical assessment, ECG, MUGA/gated SPECT, echocardiography with LVEF and GLS, and serial hs-Tn, NT-proBNP, and sST2.

Results: Median age was 56 years, and 62% of patients were women. Mean baseline LVEF was 60±5% and mean GLS −19.5±2.1%. During treatment, hs-Tn, NT-proBNP, and sST2 increased progressively, while LVEF declined to 57±6% and GLS to −16.6±2.5% at treatment completion. Imaging-defined cardiac dysfunction occurred in 30% of patients, including overt cardiotoxicity in 10%. Changes in hs-Tn correlated most strongly with GLS (r=−0.42, p=0.002). The integrated model showed the best predictive performance (AUC 0.91).

Conclusions: Beyond diagnostic value, this multimodal model may support multidisciplinary decision-making in surgical oncology by identifying patients who require intensified surveillance, early cardioprotection, preoperative optimization, or adjustment of treatment sequencing. The findings should be interpreted as clinically promising and hypothesis-generating, requiring multicenter validation before routine implementation.

Keywords: cardiotoxicity, antineoplastic therapy, radionuclide imaging, global longitudinal strain, biomarkers, multidisciplinary care