Chemotherapy-associated cardiotoxicity in women with breast cancer: assessment of left atrial strain by transthoracic echocardiography

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BACKGROUND

Transthoracic echocardiography (TTE) is considered the gold-standard method for assessing cardiac function, with left ventricular ejection fraction (LVEF) and global longitudinal strain (GLS) being the main parameters used for early detection of cardiotoxicity.
Left atrial (LA) strain represents the myocardial deformation of this structure and is assessed based on three main parameters, among which peak atrial longitudinal strain (PALS) stands out for best reflecting global LA function.

PURPOSE

To evaluate left atrial strain by TTE as a predictor of cardiotoxicity at different stages of treatment with anthracyclines and trastuzumab in women with breast cancer.

METHODS

Study design: retrospective, quantitative, descriptive and correlational.

Population: women > 18 years with breast cancer.

Sample: 51 women with breast cancer underwent chemotherapy with anthracyclines and trastuzumab beetween 2021 and 2024.

Study variables: peak E-wave velocity, peak A-wave velocity, E/A ratio, septal e' velocity, lateral e' velocity, average E/e' ratio, LA volume index, peak tricuspid regurgitation velocity, GLS, LVEF and PALS.

RESULTS AND DISCUSSION

GROUP OF WOMEN WHO DID NOT DEVELOP CARDIOTOXICITY

Tabel 1 – p-values for comparisons in the group of women who did not develop cardiotoxicity

Variables	Baseline TTE - TTE 2	Baseline TTE – TTE 3	Baseline TTE – Final TTE
Peak E-wave velocity (cm/s)	**0,040**	1,000	**0,021**
Peak A-wave velocity (cm/s)	0,090	**0,049**	**0,001**
E/A ratio	0,627	0,589	0,918
Septal e' velocity (cm/s)	**0,010**	**0,013**	**0,041**
Lateral e' velocity (cm/s)	**<0,001**	0,066	**0,001**
Average E/e' ratio	0,189	0,179	0,095
LA volume index (mL/m^2)	**0,031**	**0,014**	0,082
Peak TR velocity (cm/s)	0,115	0,179	0,485
GLS (%)	**<0,001**	**<0,001**	**0,018**
LVEF (%)	**<0,001**	**<0,001**	**<0,001**
PALS (%)	**0,010**	0,053	0,156

Tabel 2 – Relative variation of the mean values of the research variables in the group of women who did not develop cardiotoxicity

Variables	Baseline TTE – TTE 2	Baseline TTE – TTE 3	Baseline TTE – Final TTE
GLS (%)	-4,53%	-4,48%	-3,44%
PALS (%)	-7,54%	-6,80%	-4,83%

Cardiac function remained globally preserved throughout the follow-up, with no significant changes in conventional parameters such as LVEF and GLS. However, subtle variations ere observed in more sensitive parameters, such as PALS, suggesting the possible presence of early subclinical changes.

GROUP OF WOMEN WHO DID DEVELOP CARDIOTOXICITY

Tabel 3 – p-values for comparisons in the group of women who develop cardiotoxicity

Variables	Baseline TTE - TTE 2	Baseline TTE – TTE 3	Baseline TTE – Final TTE
Peak E-wave velocity (cm/s)	0,987	0,313	0,407
Peak A-wave velocity (cm/s)	0,388	0,240	0,610
E/A ratio	0,360	0,594	0,941
Septal e' velocity (cm/s)	0,926	**0,034**	0,089
Lateral e' velocity (cm/s)	0,310	**0,002**	**0,028**
Average E/e' ratio	0,769	**0,048**	0,360
LA volume index (mL/m^2)	0,120	**0,019**	0,141
Peak TR velocity (cm/s)	0,616	0,532	0,203
GLS (%)	**0,002**	**<0,001**	**0,006**
LVEF (%)	**0,008**	**<0,001**	**<0,001**
PALS (%)	0,054	0,294	0,540

Tabel 4 – Relative variation of the mean values of the research variables in the group of women who did not develop cardiotoxicity

Variables	Baseline TTE – TTE 2	Baseline TTE – TTE 3	Baseline TTE – Final TTE
GLS (%)	**-15,34%**	**-26,23%**	**-15,20%**
PALS (%)	**-15,15%**	-12,67%	-4,25%

A progressive deterioration of cardiac function was observed throughout treatment, with significant reductions in LVEF and GLS, as well as changes in atrial and diastolic function parameters. These findings reflect a cumulative impact of oncologic therapy on myocardial function.

CONCLUSION

GLS and **LVEF** were the most **sensitive** echocardiographic parameters for differentiating between groups with and without cardiotoxicity;

Septal and **lateral e' velocities** allowed identification of diastolic function alterations from intermediate stages onward;

PALS demonstrated discriminative capacity at an early time point.

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