Chemotherapy-associated cardiotoxicity in women with breast cancer: assessment of myocardial work index by transthoracic echocardiography

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BACKGROUND

Breast cancer is one of the most common malignancies worldwide. Despite advances in treatment, these therapies can increase the risk of cardiotoxicity, making cardiac monitoring crucial in this population. The Myocardial Work Index (MWI) has emerged as a tool to predict the risk of cardiotoxicity, Using the left ventricular pressure-strain loop technique, MWI evaluates myocardial work and calculates global work index (GWI), global wasted work (GWW), global constructive work (GCW), and global work efficiency (GWE).

PURPOSE

To determine the added value of myocardial work indices compared with global longitudinal strain (GLS) assessed by transthoracic echocardiography (TTE) in the diagnosis of chemotherapy-associated cardiotoxicity in women with breast cancer.

METHODS

Study design: retrospective, quantitative, descriptive and correlational.

Population: women > 18 years with breast cancer.

Sample: 40 women with breast cancer underwent chemotherapy with anthracyclines and trastuzumab beetween 2020 and 2023.

Study variables: systolic and diastolic blood pressure, left ventricular ejection fraction (LVEF), GLS, GWI, GWW, GCW, and GWE

RESULTS AND DISCUSSION

GROUP OF WOMEN WHO DID NOT DEVELOP CARDIOTOXICITY

Tabel 1 – Mean values of the research variables for the group of women who did not develop cardiotoxicity

Variables	TTE 1	TTE 2	TTE 3	TTE 4
LVEF (%)	67,29	65,22	64,26	64,56
GLS (%)	-21,85	-20,90	-20,70	-20,64
GCW (mmHg)	2608,22	2416,19	2412,70	2476
GWW (mmHg)	163,48	164,33	196,37	188,37
GWE (%)	93	93	92	93
GWI (mmHg)	2105,59	1957,70	1933,85	2006,15

Tabel 2 – Distribution of women with indices above or below reference values in the non-cardiotoxicity group

	Reference Values	TTE 1	TTE 2	TTE 3	TTE 4
GWI	< 1310	0	2	0	0
GCW	< 1543	0	0	0	0
GWI	> 278	2	2	4	2
GWE	< 90	2	2	7	4

In women who did not develop cardiotoxicity, LVEF and GLS progressively decreased from TTE1 to TTE3, with partial recovery at TTE4, without reaching predictive values for cardiotoxicity. GCS and GWI showed a similar pattern, decreasing during treatment and increasing afterwards. GWE remained stable initially, decreased at TTE3, and fully recovered at TTE4, while GWD increased until TTE3 and decreased afterwards, without returning to baseline values.

GROUP OF WOMEN WHO DEVELOP CARDIOTOXICITY

Tabel 3 – Mean values of the research variables for the group of women who develop cardiotoxicity

	TTE 1	TTE 2	TTE 3	TTE 4
LVEF (%)	65,62	58,38	53,69	58
GLS (%)	-20,64	-17,20	-15,69	-16,11
GCW (mmHg)	2643,39	2249,15	2058,31	2231,85
GWW (mmHg)	242,46	272,08	295,3077	278,46
GWE (%)	91	89	86	88
GWI (mmHg)	2131,15	1764,08	1559,769	1756,85

Tabel 4 – Distribution of women with indices above or below reference values in the cardiotoxicity group

	Reference Values	TTE 1	TTE 2	TTE 3	TTE 4
GWI	< 1310	0	2	2	2
GCW	< 1543	0	1	2	0
GWI	> 278	5	3	8	6
GWE	< 90	5	3	11	6

Women who developed cardiotoxicity presented slightly lower baseline LVEF and GLS values compared with those who did not develop cardiotoxicity, although without significant differences. The indices showed a similar pattern in both groups; however, reductions in GCS, GWE, and GWI, as well as the increase in GWD, were more pronounced in the cardiotoxicity group. Overall, women who developed cardiotoxicity exhibited greater changes in myocardial work indices compared with those without cardiotoxicity.

Tabel 5 – Pearson correlation between the relative variation of the indices and GLS, p-value and strength of association

Relative Change	Pearson's r	p-value	Correlation Strength
GWI_TTE2_TTE1 vs GLS_TTE2_TTE1	0,717**	<0,001	Strong
GWI_TTE3_TTE1 vs GLS_TTE3_TTE1	0,628**	<0,001	Moderate
GWI_TTE4_TTE1 vs GLS_TTE4_TTE1	0,313*	0,050	Weak
GCW_TTE2_TTE1 vs GLS_TTE2_TTE1	0,707**	<0,001	Strong
GCW_TTE3_TTE1 vs GLS_TTE3_TTE1	0,588**	<0,001	Moderate
GCW_TTE4_TTE1 vs GLS_TTE4_TTE1	0,316*	0,047	Weak
GWW_TTE2_TTE1 vs GLS_TTE2_TTE1	0,037	0,820	Very weak
GWW_TTE3_TTE1 vs GLS_TTE3_TTE1	0,108	0,507	Very weak
GCW_TTE4_TTE1 vs GLS_TTE4_TTE1	0,036	0,828	Very weak
GWE_TTE2_TTE1 vs GLS_TTE2_TTE1	0,570**	<0,001	Moderate
GWE_TTE3_TTE1 vs GLS_TTE3_TTE1	0,418**	0,007	Strong
GWE_TTE4_TTE1 vs GLS_TTE4_TTE1	0,188	0,245	Very weak

The table should be interpreted as follows: for example, GWI_TTE2_TT1 vs GLS_TTE2_TTE1 indicates that Pearson's correlation was performed between the relative change in GWI from TTE1 to TT2 and the relative change in GLS from TTE1 to TTE2.

CONCLUSION

This study highlighted the added value of MWI relative to GLS in diagnosing cardiotoxicity in women with breast cancer. The results showed that MWI behaves similarly to GLS, suggesting that combining the two methods—MWI and GLS—may enhance the detection of cardiotoxicity.

REFERENCES

Lyon AR et al. 2022 ESC Guidelines on cardio-oncology developed in collaboration with the European Hematology Association (EHA), the European Society for Therapeutic Radiology and Oncology (ESTRO) and the International Cardio-Oncology Society (IC-OS): Developed by the task force on cardio-oncology of the European Society of Cardiology (ESC). Eur Heart J