Early detection of chemotherapy-related cardiotoxicity

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Background

Cardiotoxicity is a serious side effect of chemotherapy. Cancer treatment with chemotherapy (ChT) may induce acute and/or chronic cardiac damage. This could lead to significant complications, quality of life violations and increased cardiovascular morbidity and mortality.

Aim

To assess cardiac function during ChT using echocardiographic parameters and biomarkers for oxidative and cellular stress, myocardial necrosis and heart failure.

Methods

Seventy five patients (56±11 years, 16 males) with histologically proved tumors of breast (n=50), colon and rectum (n=11), lungs (n=9) and other types (n=5), were examined with echocardiography and laboratory before ChT, at 6 months during ChT and at 1 year from the beginning (3 months after ChT). Conventional, PW-Doppler (Fig. 1) and PW-tissue Doppler echocardiography was performed. Ejection fraction was calculated using the Simpson’s rule. Peak systolic, early diastolic and late diastolic velocities at the medial mitral annulus (Sm, E’m and A’m, Fig. 2) and lateral mitral annulus (Sl, E’l and A’l) were measured. Plasma levels of brain natriuretic peptid (BNP), myeloperoxidase, troponin and heat shock protein 70 were measured.

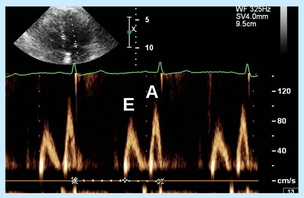

Fig. 1. PW-Doppler of mitral filling.

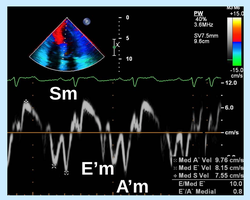

Fig. 2. PW-TDI of the mitral annulus.

Results

During the follow-up period impairment of left ventricular ejection fraction was not observed. Early diastolic mitral annular velocities E’m and E’l decreased progressively from the beginning to 1 year after starting ChT (Table 1 and 2, Fig. 1 and 2). Statistically significant increase in E/E’m and E/E’l ratios was registered (Table 1 and 2, Fig. 3 and 4).

Table 1. Tissue Doppler parameters of the medial mitral annulus.

Parameter	**Before ChT**	**On ChT (at 6 m.)**	**After ChT (at 1 year)**	***P* 1 vs. 2**	***P* 1 vs. 3**
Sm, cm/s	6.72±1.68	6.39±1.68	6.48±1.10	NS	NS
E’m, cm/s	7.76±2.12	7.09±2.21	6.78±2.29	**0.004**	**0.001**
A’m, cm/s	9.87±2.25	9.37±1.73	9.41±1.92	**0.042**	NS
E’m/A’m	0.84±0.39	0.77±0.33	0.75±0.29	**0.007**	**0.005**
E/E’m	10.02±2.36	11.54±2.95	12.37±3.26	**<0.0001**	**<0.0001**

Table 2. Tissue Doppler parameters of the lateral mitral annulus.

Parameter	**Before ChT**	**On ChT (at 6 m.)**	**After ChT (at 1 year)**	***P* 1 vs. 2**	***P* 1 vs. 3**
Sl, cm/s	7.80±1.90	7.21±1.50	7.29±1.35	**0.009**	**0.029**
E’l, cm/s	10.46±2.84	9.62±2.85	8.99±2.86	**0.013**	**<0.0001**
A’l, cm/s	11.30±0.38	10.51±0.37	10.58±0.35	NS	NS
E’l/A’l	1.01±0.45	0.97±0.43	0.90±0.42	NS	NS
E/E’l	7.56±2.30	8.39±2.51	9.27±2.78	NS	**<0.0001**

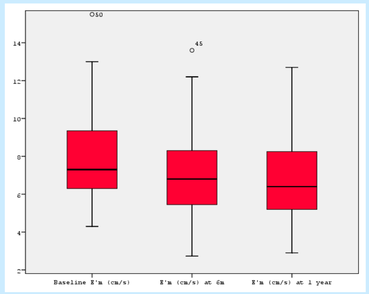

Fig. 1. E’m of medial mitral annulus.

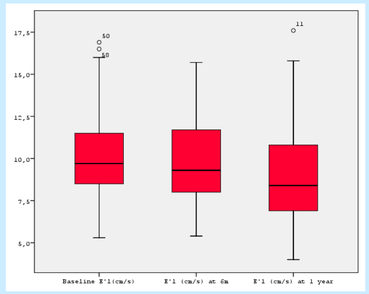

Fig. 2. E’l of lateral mitral annulus.

Results

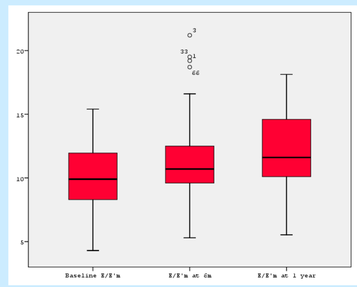

Fig. 3. E/E’m ratio.

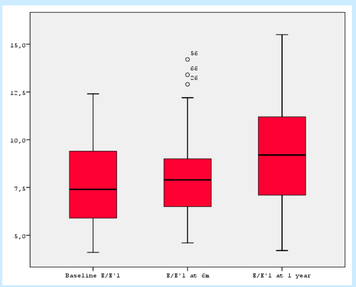

Fig. 4. E/E’l ratio.

The levels of BNP increased significantly from 48.81±41.92 pg/ml to 94.00±134.04 pg/ml (p=0.04) and the levels of myeloperoxidase from 1.71±0.6 U/ml to 1.98±0.7 U/ml (p=0.001) at the 6-th month. These parameters returned to initial values at 1 year.

No significant changes were registered in troponin and heat shock protein 70 throughout the study.

During the follow-up period 5 patients developed hypertension, two patients – rhythm disorders, one patient – congestive heart failure and one patient died due to cancer progression.

Conclusions

Asymptomatic LV diastolic dysfunction was developed in patients with preserved ejection fraction during and after ChT. There was a trend for elevation of plasma levels of BNP and myeloperoxidase during therapy but they remained in normal limits.

Regular assessment of cardiac function is advisable for monitoring cardiotoxicity and guiding ChT.