Evaluation of Myocardial Functions in Children Receiving Anthracyclines


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Objectives

In our study, using echocardiographic measurements in patients with acute lymphoblastic leukemia receiving anthracycline therapy have evaluated presence of anthracycline-induced cardiac dysfunction and it has been carried out to determine the statistical echocardiographic parameters that best predict it.

Methods

Thirty cases (mean age 9.87±3.92 years, 13 males and 17 females ) with pediatric hematological conditions receiving anthracycline therapy were enrolled in the study, along with 30 age-matched controls. Their cardiac functions were evaluated echocardiographically with two dimensional, M-mode, PW Doppler and PW tissue Doppler methods. PW tissue Doppler measurements of time intervals in order to determine left ventricular MPI (modified Tei index) were performed using PW tissue Doppler mode, sample volume at the intersection of LV free wall and mitral annulus.

Three different flow waves were recorded from this point (Figure 1); Time interval from the end of mitral A wave to the onset of mitral E wave was determined as total ventricular systole (a). LV ejection time was determined by measuring systolic ejection flow. Time interval from the onset to the end of this wave was recorded as ejection time (b). The positive wave heading towards the apex during systole (S) represents ventricular ejection, the first wave going away from the transducer and showing ventricular filling during diastole represents rapid-passive ventricular filling (E) and the second wave represents ventricular filling (A) caused by atrium contraction. PW tissue Doppler MPI (left V) was calculated by subtracting ventricular ejection time (b') from left ventricular systol time (a') and dividing the remainder by ventricular ejection time (a'-b'/b').

Results

The left ventricular cardiac functions were significantly reduced in the study group. The fractional shortening (FS) was 36.09 ± 3.17% (range 28-41%) in the study group as opposed to 39.65 ± 3.21% (34-45%) in controls (p= 0.03 ). The Diastolic functions (E/A ratio) weren’t significantly change in the study group. (Right ventricular (RV) flow E/A 1.36±0.29 and 1.34±0.69, p>0.05. Left ventricular (LV) flow E/A 1.53±0.31 and 1.58±0.35, p> 0.05. The myocardial performance index (MPI) was calculated in the study subjects using both PW Doppler and PW tissue Doppler methods and compared to controls. RV flow MPI 0.39±0.02 and 0.33±0.03, p< 0.01. LV flow MPI 0.41±0.08 and 0.34±0.04, p < 0.01. RV tissue MPI 0.44±0.04 and 0.39±0.05, p< 0.01. LV tissue MPI 0.42±0.02 and 0.36±0.01, p < 0.01.

Conclusions

The results of our study show that MPI (especially LV flow MPI, LV tissue MPI) and systolic functional changes are better indicators of anthracycline cardiotoxicity than are diastolic functions. We suggest that LV flow MPI and LV tissue MPI be primarily used in the search for anthracycline cardiotoxicity.

Figure 1. Three different flow waves were recorded using PW tissue Doppler mode, sample volume at the intersection of LV free wall and mitral annulus.