# Summary

Heart failure is a major health problem in which reduced functional capacity, exercise tolerance, and quality of life are the most basic findings. Despite improvements in diagnosis and treatment; it is associated with high morbidity and mortality.

Although cardiopulmonary tests, exercise testing and walking test provide reliable and objective results about the functional capacity; NYHA functional classification remains the most widely used because of being easy, cheap and practical.

Various markers of left ventricular (LV) systolic and diastolic function derived from Doppler echocardiography have been used to predict functional capacity, including LV cavity dimension, ejection fraction, and transmitral inflow velocity.

TDI is a new echocardiography technique that enables the evaluation of the global and regional LV longitudinal functions by the analysis of systolic and diastolic myocardial velocities obtained from mitral annulus but there are few data on the correlation of TDI variables with clinical feature in patients with LV dysfunction.

**The aim of the study** was to investigate the correlation between the NYHA functional class and both the conventional and Doppler tissue imaging (TDI) echocardiographic parameters in patients with heart failure.

This study was carried out on sixty consecutive patients from the attendant of cardiology department in Benha university hospital, presented with heart failure and their left ventricular ejection fraction (LVEF) > or =30% and less than 50%. These patients were divided according to NYHA functional class into two groups:

**Group I:** 30 patients with NYHA class I-II.

**Group II:** 30 patients with NYHA class III-IV.

The exclusion criteria were patients with rheumatic valvular and conginital heart diseases, patients with AF, patients with poor echogenicity including patients with COPD, patients with advanced liver and kidney disease, sever anemia and patients with neurological diseases.

All patients in the study were subjected to **History taking** and with special attention to sex, age, occupation, risk factors including (diabetes mellitus, hypertension, and smoking), the cause of heart failure, presence of symptoms of left ventricular failure and determination of NYHA functional class, **12-leads surface ECG** searching for ischemic changes, left ventricular hypertrophy (LVH), left bundle branch block (LBBB), **plain chest X-ray** searching for signs of heart failure and exclusion of pulmonary diseases**, routine laboratory** tests including hemoglobin, random blood sugar, serum creatinin and blood urea, transthoracic echocardiography; all patients were examined in left lateral position and standard views for M-mode, two dimensional and Doppler studies were obtained including left ventricular end diastolic diameter (LVEDd), left ventricular end systolic diameter (LVESd), left atrial diameter (LAD), left ventricular EF by 2D, left ventricular stroke volume (SV), peak velocity of early filling (E), peak velocity of late filling (A), E/A ratio E -wave deceleration time (EDT) and **tissue Doppler echocardiography** using pulsed wave DTI; mitral annulus velocities were recorded from septal and lateral sites and averaged; including; Sa wave, Ea wave, and Aa wave, Ea/Aa ratio was calculated and The ratio of early transmitral LV filling velocity (E) to early diastolic Doppler tissue imaging velocity of the mitral annulus (E/Ea ratio) was calculated.

All the conventional echocardiogaphic parameters and DTI parameters were compared between the two groups of patients and correlated with NYHA functional class of the patients and a correlation between LVEF and Sa was made.

In our study we found that; as regarding conventional echocardiographic parameters there was significant statistical difference between group I and group II as regarding LVEDd, LVESd, and LAD in cm with larger diameters (6.073 ± 1.00, 5.07 ± 0.99, and 4.75 ± 0.6 respectively) in group II than in group I (5.376 ± 1.205, 4.49 ± 0.60, 4.24 ± 0.7 respectively) (*P* value <0.05).

Concerning LVEF%, left ventricular SV in ml and EDT in ms; there was significant statistical difference between the two groups (*P* value <0.05) with larger values in group I patients (41.06 ± 6.61, 77.12 ± 27.5, and 141.23 ± 35.49 respectively) than group II (35.36 ± 7.8, 61.76 ± 21.06, and 118.73 ± 35.56 respectively).

There was no significant statistical difference between the two groups as regarding peak E wave, peak A wave velocities and E/A ratio of mitral inflow (*P* value >0.05).

As regarding TDI parameters; there was highly significant statistical difference between the two groups as regarding systolic mitral annular velocity (Sa) in cm/s (*P* value <0.001), and significant statistical difference between the two groups as regarding early and late diastolic mitral annular velocities (Ea, Aa) in cm/s (*P* value <0.05) with larger values in group I (6.18 ± 1.21, ٧,٠٨ ± ٢,٤٧, and 7.98 ± 1.79 respectively) than group II (4.46 ± 0.57, 5.56 ± 1.28, and 5.51 ± 1.65 respectively). There was highly significant statistical difference between the two groups as regarding E/Ea ratio (*P* value <0.001) with larger E/Ea ratio in group

II (15.7 ± 6.6) than in group I (9.73 ± 2.97). Ea/Aa ratio showed no significant statistical difference between the two groups (*P* value >0.05).

In this study we found that LVEDd, LVESd, and LAD were in significant positive correlations with NYHA functional class (r =0.31, r =0.34, and r =0.44 respectively; *P* value <0.05), and LVEF%, left ventricular SV, and EDT were in significant inverse correlation with NYHA functional class (r =-0.46, r =-0.26, and r =-0.27 respectively; *P* value <0.05). Peak E wave velocity, peak A wave velocity, and E/A ratio showed no significant correlation with NYHA functional class (*P* value >0.05).

As regarding TDI parameters including Sa, Ea, and Aa velocities; a significant inverse correlation were found between these parameters and NYHA functional class. E/Ea ratio showed significant positive correlation with NYHA functional class. Ea/ Aa showed no significant correlation with NYHA functional class.

A linear regression analysis of different conventional and TDI parameters was done and showed that the systolic mitral annular velocity (Sa) and left ventricular ejection fraction (LVEF) were independent parameters of functional capacity (beta=-0.295, *P* value < 0.05 and beta=-0.287, *P* value < 0.05 respectively).There was significant correlation between LVEF and Sa (r=0.36, and *P* value<0.01)

**Our study conclude that**; There is significant relationship between mitral annular velocities and functional capacity in patient with heart failure, and Sa, in particular, has the strongest association compared to conventional echocardiographic and other TDE parameters.

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