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Global Longitudinal Strain and Post Systolic Index as Related To E/eˀ Ratio in Male Patients with Hypertension

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Abstract: High incidence of morbidity and mortality is associated with systemic hypertension because to its negative effects on a variety of systems, particularly the cardiovascular system. Diastolic dysfunction is a prominent component of this illness, and despite growing recognition of its importance, it is still underappreciated due to its challenging identification and lack of effective treatments. Despite the presence of normal left ventricular (LV) systolic indices, estimate of LV systolic function using strain concepts has recently been shown to be able to differentiate patients with systolic dysfunction. There is little evidence linking hidden myocardial alterations to diastolic dysfunction. The goal of this study is to determine occult left ventricle systolic dysfunction and its relationship to diastolic dysfunction in non-complicated hypertensive patients under the age of 40. Methods: This study included a total of 100 young male volunteers. The research will run from January until April 2020. A sample was taken from the Al-Furat teaching hospital's consulting room.. Hypertensive patients are grouped as group A (E/eˀ <10, n:50) and group B (E/eˀ ≥10, n:50). On the echocardiograph, strain analysis was performed using proprietary software. Results: In hypertensive patients with E/eˀ <10 versus those with E/eˀ ≥10, there is no statistically significant difference between the average GLS (*P value:0.7*) and average PSI (*P value: 0. 5*). Conclusion: Compared to diastolic function status, no significant change in GLS and PSI are evident in hypertensive non-complicated patients.

Key words: Global Longitudinal Strain, Post Systolic Index.

Abbreviation: GLS: Global Longitudinal Strain. PSI: Post Systolic Index. LV: Left ventricle.

Introduction

A high incidence of morbidity and mortality is associated with systemic hypertension owing to its multisystem harmfulness, especially to the cardiovascular system.(1) In hypertensive patients, abnormal left ventricle geometry as well as fibrosis of myocardial tissue are discovered early, before any obvious functional abnormalities..(2) Diastolic impairment is a prominent component of this illness, and despite the growing recognition of its importance, it is still underappreciated due to its challenging diagnosis and lack of effective treatments.(3) Currently, electrocardiography and echocardiography are used to assess the asymptomatic cardiac insult caused by hypertension.. (4)

With diastolic dysfunction, left ventricle filling shifts to the end of the diastole, putting increased reliance on atrial contractility. Doppler echocardiography can detect these occurrences.. (5)

The E wave is caused by rapid filling of the ventricle in early diastole, whereas the A wave is caused by atrial contraction. In normal circumstances, the E wave is higher than the A wave on Doppler, but in case of abnormal diastole, or slow relaxation stage, the E wave becomes smaller than the A wave. In individuals with diastolic dysfunction, however, the LV ET (which is defined as the time gap between the aortic valve opening and its closure) increases. It has been demonstrated that in isolated diastolic dysfunction, the left ventricular ejection time is prolonged and is related to the severity of diastolic impairment. (6)

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Many researchers have identified anomalies in diastolic indices in the presence of acceptable systolic function as evidenced by ejection fraction or fractional shortening, leading to the conclusion that diastolic abnormalities can occur before or independently of systolic abnormalities.(7)

The strain of myocardial tissue, a dimensionless estimate of deformation, can be used to differentiate subclinical abnormalities in left ventricular function. Two-dimensional (2D) speckle tracking is a new echocardiographic technique for examining longitudinal, circumferential, and radial fiber stresses in the left ventricle. This method assesses myocardial mobility by observing natural acoustic reflections and interference patterns in two-dimensional echocardiographic images, and has been validated using MRI and sonomicrometry estimates.(8)

Small speckles are created by the interaction of ultrasound with cardiac tissue in the region of interest. Segmental and global myocardial deformation can be determined by tracking frame-to-frame over the cardiac cycle and measuring distances between speckles or their spatiotemporal displacement.

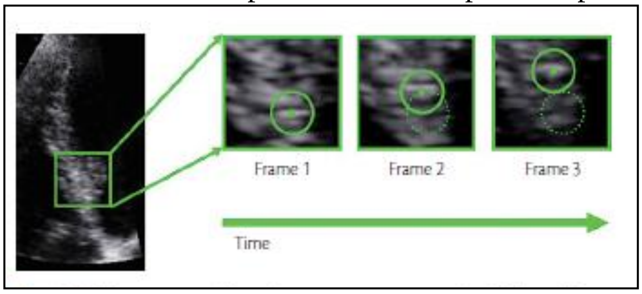

Figure 1: Prominent speckles in the image are recognized and followed frame by frame. The measures displacement between frame allows calculation of velocity and direction of motion. Tracking several speckles allows the calculation of two-dimensional deformation

Longitudinal shortening after closure of the aortic valve, or what is called PSS (post systolic shortening), is of particular importance since it detects segmental abnormalities with exceptional sensitivity. During a stress echo, a recently developed PSI is a hallmark of ischemic insults. On the other hand, pre-existing post-systolic contraction is only likely to be an indicator of ischemic insult if systolic shortening is reduced and PSS surpasses 20% of overall curve amplitude. It can be utilized also as an indicator for prognosis in arrhythmias. (9)

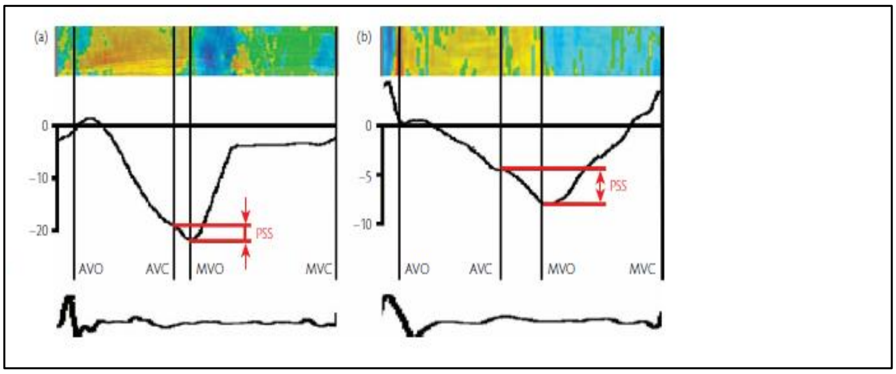

Figure 2 Post-systolic shortening (PSS) in strain curve, a: physiologic PSS usually occur around the apical and basal septum and has minor amplitude, b: pathologic PSS is often accompanied by reduced systolic function and exceed 25-30% of the overall curve amplitude.

Methods

After receiving their verbal and written consent, a total of 100 young males participated in this study. The research will run from January until April 2020. A sample was taken from the Al-Furat teaching hospital's consulting room.

Young patients with hypertension who are taking antihypertensive medication are eligible. The term "young age" refers to people who are between the ages of 18 and 40 years.(10) Clinical and biochemical assessments were carried out to ensure that there was no clinical evidence of heart disease, diabetes mellitus, pulmonary insults, or renal dysfunction, and there was no previous history of these conditions. Subjects who have been identified as having primary non-complicated hypertension (no damage to end organ) and are taking

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antihypertensive drugs are included in the study. In our investigation, we did not look at the statistical impact of treatment mode on study variables. The patients were studied as two groups; A (E/e' <10, n:50, age 23–37yr, BMI: 20.8–28.7) and B (E/e' ≥10, n: 50, age 20–40yr, BMI: 22.9–37).
All patients have a comprehensive two-dimensional echocardiogram. Examination was done by M5sc probe, GE, Vivid E9, 2015, made in USA (Figure 3).

Figure 3 Vivid E9 echo equipment

Echocardiographic assessment is done in the left lateral decubitus, by the same operator. The E and A waves of mitral valve inflow, in addition to the deceleration time, are measured using pulsed-wave Doppler**.** The peak early diastolic velocity of the lateral and medial mitral annulus (e′) is determined using tissue Doppler in the apical Four chamber view to yield average E/e'.

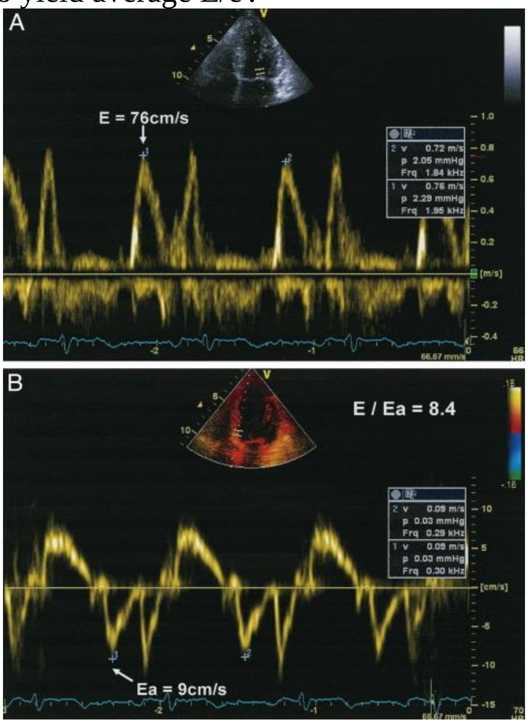

Figure4 E/e' ratio measurement

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For the purpose of global longitudinal strain assessment, three acquisitions are used (2-champer, 4-chamber, and 3-chamber). The examiner marks specific spots on each view (the apex and 2 spots on each mitral annulus). The software then determines peak systolic longitudinal strain in matching regions of each image, as well as determining aortic valve closure. The average longitudinal strain for these three viewpoints is used to calculate global longitudinal strain. Then the strain curve is extracted. Another map is used to obtain the post systolic index

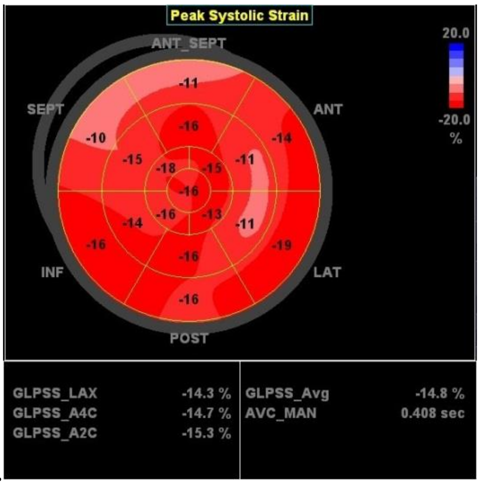

Figure 5 Bulls-eye figure of peak systolic strain

Analytic cross sectional study design is conducted using SPSS 18. Data are analyzed as per group A (E/e' <10, n:50) and group B (E/e' ≥10, n:50). Calculation of mean, standard deviation and standard error of mean are done. Study groups are compared using independent T test. P value of <0.05 is significant (α=0.05).

Results:

No significant difference in GLS (P value: 0.7), (figure 6). Though PSI (figure 7) is mildly elevated in patients group with E/e' ratio ≥10 but statistically not significant (P value: 0.7).

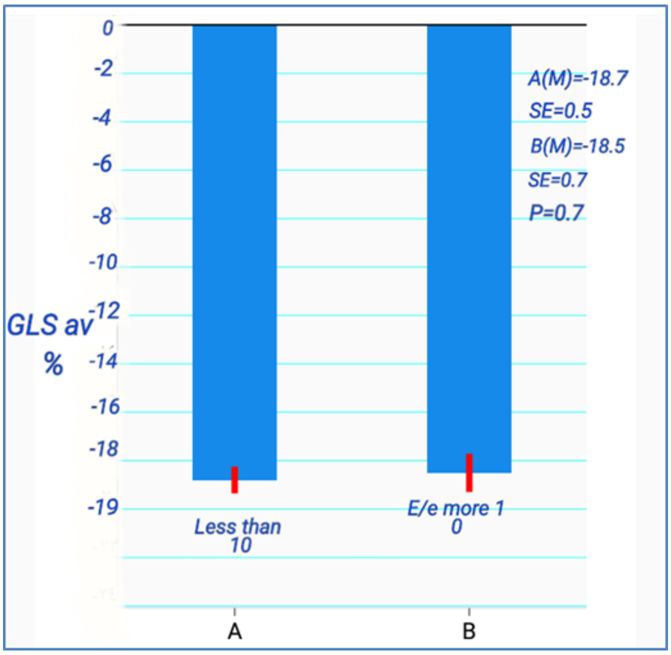

Figure 6 Global longitudinal strain average (GLS av), (%) in (A) group (E/e' <10, n:50) and (B) group (E/e' ≥10, n:50)

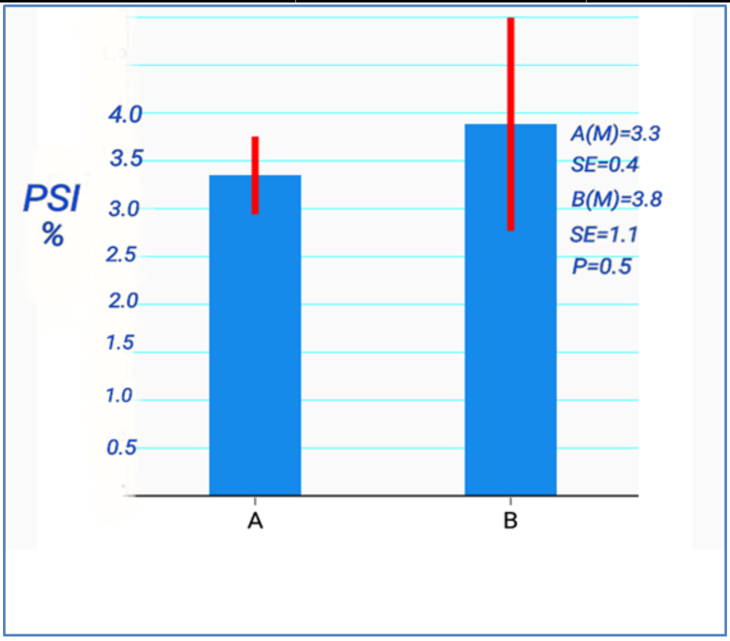

Figure 7 Post-systolic index (PSI), (%) in (A) group (E/e, <10, n:50) and (B) group (E/e, ≥10, n:50)

Discussion

Patients with systemic hypertension may have a high left ventricle filling pressure but normal systolic parameters like ejection fraction and fractional shortening. Nonetheless, these endocardial border-derived indicators are primarily concerned with the global status of the left ventricle rather than localized myocardial abnormalities. Despite the existence of normal 2D derived systolic measures, 2D speckle tracking can now detect segmental systolic anomalies and consequently subclinical alterations.(10)

Abnormal diastole is the most common type of LV dysfunction caused by systemic hypertension, and it exists independently of LV systolic function, therefore poor diastolic parameters can be identified with normal systolic indices. (12) We looked at the findings of a study published in 2000 by Giovanni de S et al, which found that aberrant diastolic insults can be detected in hypertensive individuals with normal or supranormal systolic function. (12)

Another study by Jasmine G. et al., 2009 (13) supports our findings, revealing that diastolic dysfunction is a powerful reflector of symptoms in hypertension individuals. E/e′ of 15 or more has been proven to have a strong correlation with invasively measured LV end-diastolic pressure..(14)

They also discovered that resting E/e′ of 15 or higher was associated with a decrease in exercise ability. They differ from our study in that we used a threshold value of 10 for E/e′ to distinguish those with increased filling pressure of LV from those with normal filling pressure. (13) Furthermore, they hypothesized that exercise ability is unrelated to systolic blood pressure. This study's findings were similar to ours, although we differ in that we assess systolic function using GLS and PSI rather than EF and FS.

Conclusion:

Though there is evidence of diastolic dysfunction and increase left atrial pressure in some patients with hypertension, no significant subclinical systolic dysfunction is present compared to hypertensive patients with normal filling pressure.

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