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The Role of Speckle Tracking for Differentiating Patients with Hypertensive Cardiac Hypertrophy from Athlete's with Moderate Left Ventricular Hypertrophy

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Abstract

Hypertensive cardiac hypertrophy is a leading cause of morbidity and death, which motivates our study's focus on these issues. Conditions include heart attacks, irregular heartbeats, diastolic dysfunction, heart failure, and sudden cardiac death fall under this category. A concentric cardiac hypertrophy pattern, like that seen in hypertensive hypertrophy, is also seen in athletes who participate in intense strength training. On the other hand, unlike hypertension hypertrophy, which may have dire consequences, athletic hypertrophy is generally seen as a harmless physiologic response. The research aimed to use speckle tracking echocardiography to identify mild LVH in athletes and distinguish it from hypertensive LVH in patients. A total of 105 participants were included in this prospective case control study and were randomly assigned to one of three groups: 45 healthy, inactive people served as the "healthy group." Patients with hypertension-related LVH numbered 30, whereas athletes with concentric LVH numbered 30 in the athletes group. The results showed that there were no statistically significant differences (p>0.05) in age, height, or body mass index between the groups that were analysed. The mean body mass index was significantly different between the three groups (p= 0.005). Heart rate, systolic blood pressure, and diastolic blood pressure all differed significantly (p0.001) across the three groups. The heart rates of the healthy and athletic groups were found to be significantly lower than those of the hypertension group.

Keywords: Cardiac, Hypertrophy, Athlete's, HTN.

1. Introduction

Left ventricular hypertrophy (LVH) may be either healthy or pathological, and knowing the difference is crucial for treatment and/or monitoring purposes [1].

Heart failure is a common complication of hypertensive cardiac hypertrophy. Coronary artery disease, arrhythmias, diastolic dysfunction, heart failure, and sudden death are all examples [2].

Strength-trained athletes have a type of cardiac hypertrophy called concentric hypertrophy [3], which is similar to that seen in hypertensive hypertrophy.

Athletic hypertrophy, on the other hand, is seen as a benign physiologic response that has little prognostic importance in comparison to hypertensive hypertrophy [4].

Characteristics shared by these two subsets of left ventricular (LV) hypertrophy have been found via noninvasive research (LVH). With a mean systolic mitral annulus velocity of less than 0.09 m/s, Vinereanu et al. [5] were able to successfully differentiate hypertensive LVH from physiologic LVH.

Blood filling velocity across the mitral valve was shown to be slower during early diastole and faster during late diastole in hypertensive LVH, but not in trained athletes, as described by Schannwell et al [6]. Strain rate imaging (SRI) may provide more insight into these observations.

SRI is a relatively recent method for quantifying regional myocardial function, since it is a Doppler tissue imaging modality. There is some evidence that it can be used as a reliable measure of cardiac contractility [7].

The strain and strain rate profile associated with physiological LVH is poorly documented [8].

The research aimed to use speckle tracking echocardiography to identify mild LVH in athletes and distinguish it from hypertensive LVH in patients.

2. Patients and methods

This prospective case control study was carried out at Cardiology, Faculty of Medicine, Benha University during the period from May 2020 to July 2022, included 105 subjects that divided into three groups: Healthy group: 45 healthy, sedentary control subjects. Hypertensive group: 30 patients with LVH secondary to hypertension, Athletes group: 30 strength training athletes with concentric LVH.

The inclusion criteria for patients with hypertensive LVH had been: Age 18-65 years; Past clinical diagnosis of hypertension; exercise stress echocardiogram negative for ischemia and hypertensive response; LV mass (LVM) index greater than 110 g/m2 in women (_135 g/m2 in men) or symmetric interventricular septum and posterior wall hypertrophy greater than 1.1 cm.

Exclusion criteria include: Moderate or severe valvular disease; History of coronary artery disease, myocardial infarction, or diabetes mellitus; Ejection fraction less than 50% by echocardiogram; and history of cardiomyopathy, congenital heart defect, open heart surgery, or ongoing arrhythmia.

All patients with hypertension discontinued beta blockers and calcium-channel blockers 24 hours before study echocardiogram. These participants were enrolled

from consecutive eligible patients at a stress echocardiogram facility.

2.1Statistical analysis

Data was collected, coded then entered as a spread sheet using Microsoft Excel 2016 for Windows, of the Microsoft Office bundle; 2016 of Microsoft Corporation, United States. Data was analyzed using IBM Statistical Package for Social Sciences software (SPSS), (IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp). The Kolmogorov-Smirnov test was used to verify the normality of distribution. Continuous data was expressed as mean ± standard deviation while categorical data as numbers and percentage. A statistical value <0.05 was considered as significant. The following tests were used: Chi-square test; used to study the association between two qualitative variables. Analysis of variance (ANOVA or F test): was used for continuous data to test for significant difference between more than two normally distributed groups. Kruskal-Wallis test: It is a non-parametric equivalent to ANOVA and used when ANOVA assumptions were violated to compare between more than two groups of skewed data. Post Hoc tests: Tukey honestly significant difference (Benferroni) test was used as a post hoc test to adjust for multiple comparisons after significant ANOVA test to indicate which significant difference between pairs of groups whereas Bonferroni post hoc test was used after significant Kruskal- Wallis test. Correlation analysis (using Spearman's method): To assess the strength of association between two quantitative variables. The correlation coefficient denoted symbolically "r" defines the strength and direction of the linear relationship between two variables

3. Results

This prospective case control study was conducted on 105 subjects that divided into three groups:

- **Healthy group:** 45 healthy, sedentary control subjects
- **Hypertensive group:** 30 patients with LVH secondary to hypertension,
- **Athletes group:** 30 strength training athletes with concentric LVH

Baseline characteristics among the studied groups. No significant differences were found between the three studied groups as regards age, & height (p>0.05). Significant difference was found between the three studied groups regarding weight (p-value<0.001) and pairwise comparison showed that weight in Athletes group was significantly lower than patients in healthy group. Also, there was significant difference between the three studied groups regarding BMI and BSA (p-value<0.001 & 0.003 respectively) and pairwise comparison showed that patients in hypertensive group had higher BSA compared to patients in healthy group

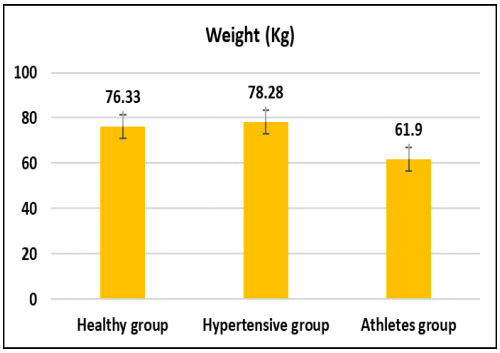

Fig. (1) Difference between the studies groups regarding weight.

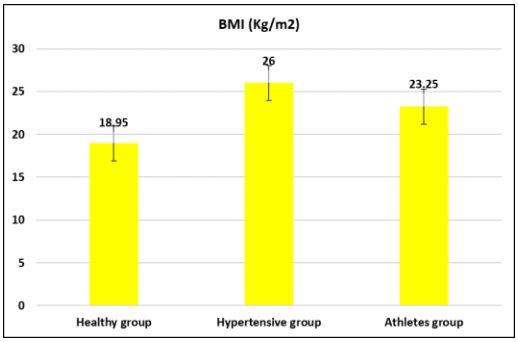

Fig. (2) Difference between the studies groups regarding BMI.

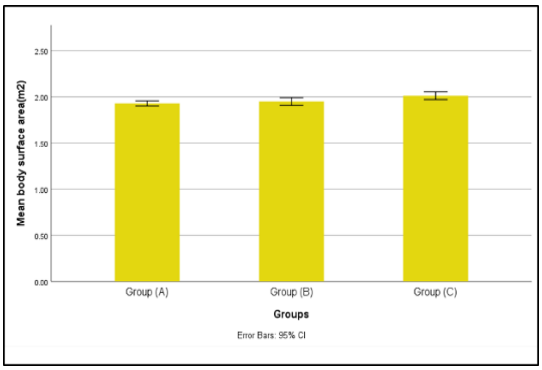

Fig. (3) Difference between the studies groups regarding BSA.

Vital signs among the studied groups. Significant difference was found between the three studied groups regarding heart rate (p-value<0.001) and pairwise comparison showed that patients in Athletes group had significant lower heart rate compared to healthy group & hypertensive group. Also, there was significant difference between the three studied groups regarding systolic & diastolic blood pressure (p-value<0.001) and pairwise comparison showed that patients in hypertensive group had higher systolic & diastolic blood pressure compared to patients in healthy group & Athletes group as shown in figures (4,5,6).

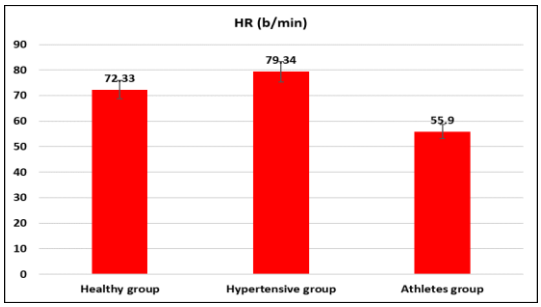

Fig. (4) Difference between the study groups regarding heart rate.

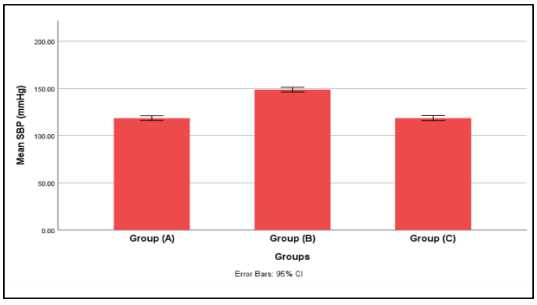

Fig. (5) Difference between the studies groups regarding SBP.

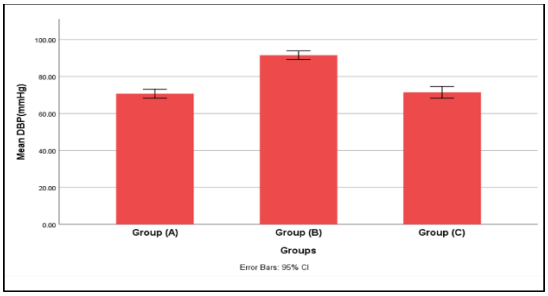

Fig. (6) Difference between the study groups regarding DBP.

4. Discussion

Heart failure is a common complication of hypertensive cardiac hypertrophy. Conditions include heart attacks, irregular heartbeats, diastolic dysfunction, heart failure, and sudden cardiac death fall under this category.

A concentric cardiac hypertrophy pattern, like that seen in hypertensive hypertrophy, is also seen in athletes who participate in intense strength training. On the other hand, unlike hypertension hypertrophy, which may have dire consequences, athletic hypertrophy is generally seen as a harmless physiologic response.

Doppler tissue imaging includes a novel technique called strain rate imaging (SRI) that may be used to quantitatively assess regional cardiac function. In certain cases, research suggests that it may be used as a reliable measure of cardiac contractility.

The purpose of this study is to use speckle tracking echocardiography to distinguish between athletes with mild LVH and patients with hypertension LVH.

There were no statistically significant variations in age, height, or body mass index (BMI) among the groups we compared in our study ($p>0.05$). Patients in the Athletes group were much higher than patients in the healthy group, and there was a statistically significant difference in weight between the three groups investigated ($p= 0.005$). Patients in the Athletes group had a greater BSA compared to patients in the healthy group, and there was a significant difference in BSA between the three groups investigated (p-value= 0.003).

One hundred four patients were examined in a sequential fashion for inclusion in the research conducted by Santoro et al. [9]. These criteria were used for inclusion: The patient has critical arterial hypertension that is well controlled by medications and echocardiographic indications of LV concentric hypertrophy with relative wall thickness >0.42. In all, 76 patients who satisfied the inclusion criteria were enrolled: 22 patients with early hypertensive cardiopathy (group B) matched for LV mass index, 37 professional athletes with cardiac hypertrophy (group A), and 17 healthy controls (group C). Age (29 5, 47 10, and 38 7) and body mass index (25 3, 23 1, and 28 2) varied significantly throughout the research sample.

Butz et al. [10] conducted another similar investigation. Out of the 53 people studied, 20 were athletes (all male, with a mean age of 27.9 4.1 years), 15 had HCM (all male, with a mean age of 41.7 10.5 years), and 18 were healthy (all male, with a mean age of 48.1 15.9 years).

Heart rate was shown to vary significantly (p0.001) across the healthy, athletic, and hypertensive groups, as measured by vital signs. Systolic and diastolic blood pressure were also significantly different across the three groups (p0.001), with patients in the hypertension group having higher readings than those in the healthy and athlete groups.

Comparisons were made between a group of elite athletes and a group of patients with hypertensive cardiopathy and healthy control individuals in an effort to describe LVT changes and the link between LVT and diastolic function. Heart rate (group A: 64 10 bpm, group B: 72 9 bpm, group C: 75 9 bpm), systolic blood pressure (group A: 120 5 bpm, group B: 134 9 bpm, group C: 121 7 bpm), and diastolic blood pressure (group A: 72 8 bpm, group B: 82 8 bpm, group

Butz et al. [10] recorded a resting heart rate of 75.5 11.4, and a peak heart rate of 185.7 13.9.

5. Conclusion

Our results show that the hypertension patients' heart rates were significantly higher than those of the healthy patients and the athletes.

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