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Comparison of Echocardiographic global longitudinal strain in patients under risk factors (diabetes and hypertension) with and without Coronary Artery Disease

Sadegh Asadi

Atherosclerosis Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran, Orcid ID: 0000-0002-6089-8938

Mohammadhassan Adel

Atherosclerosis Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran Orcid ID: 0000-0001-7165-0295

Masoud Seyedian

Atherosclerosis Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran Orcid ID: 0000-0002-7215-6851

Farzaneh Ahmadi*

Atherosclerosis Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran, Mobile: +98 916 798 0727 Orcid ID: 0000-0002-4100-8776

*Corresponding Author email: ahmadi-far@ajums.ac.ir

Abstract---Background: Global Longitudinal index (GLS) as a noninvasive diagnostic method can be influenced by coronary artery disease (CAD). In addition diabetes mellitus (DM) and hypertension (HTN) as two main risk factor of coronary involvement can affect to GLS. Therefore, the aim of this evaluation was to compare echocardiographic GLS in DM and HTN patients with significant CAD with DM and HTN patients without CAD. **Method:** In a case-control study conducted (2020-2021) in the hospitals of Ahvaz, 72 patients with and without CAD with risk factors for DM and hypertension, were examined. So that after selecting study samples that have the necessary criteria to participate in the study, the amount of GLS is calculated in each group of patients. After the data were obtained in the expressed groups, in comparison with these values, paired t-test and independent t-test and Anova, Mann-Whitney, and Levene's Test were used. P Value lower than 0.05 was consider as significant value. **Results:** From 42 patients without CAD and 38 patients with coronary artery disease, the mean and standard deviation of age in patients with CAD was 61.00 ± 8.00 and in the control group was 54.09 ± 10.00

($P = 0.019$). In addition GLS in CAD cases was 14.00 ± 3.00 and in control cases was 16.00 ± 3.00 , based on statistical evaluation there are significant difference between two groups ($P=0.003$) *Conclusion:* Based on statistical evaluations, there was a statistically significant relationship between GLS and coronary artery involvement in diabetic and hypertensive patients, so this index can be used to evaluate patients.

Keywords---*Echocardiography, GLS, Diabetic, Hypertensive, coronary arteries disease.*

Introduction

CAD develops when the major blood vessels become damaged (1-3). This condition may be asymptomatic or with few symptoms or lead to acute coronary events with rapid progression. In 18% of patients, sudden death may be the initial manifestation of CAD (4). This is the most common type of heart disease, killing more than 350,000 people per year. Also HTN as a major risk of CAD and clinical manifestations of this condition, should be considered as an important problem. In healthy cases, the lowest systolic and diastolic pressures have a relationship to lowest risk of CAD (5).

In diagnostic methods angiography as an invasive diagnostic method, faces challenges, so the use of this method has been challenged due to its cost and side effects (6). Also, this method is associated with risks and enduring a lot of mental stress for the patient and his companions (7). However non-invasive tests are increasingly being used to diagnose the presence and extent of CAD (8). There are many non-invasive tests that, along with examination and history, can help in the early detection of CAD, including Doppler Imaging (TDI), Echocardiography etc. (7).

GLS as a parameter, expresses percentage of longitudinal shortening, this is come from tracking of speckle (9). Also GLS is an emerging topic that has an important role in predicting cardiovascular outcomes (7, 10). The effect of diabetes and hypertension on GLS in echocardiography has been demonstrated in recent studies (11, 12). It was determined in a study conducted by Biering-Sørensen et al (2014) In patients with suspected stable angina pectoris, global longitudinal peak systolic strain assessed at rest is an independent predictor of significant CAD and significantly improves the diagnostic performance of exercise test(8). Based on this, longitudinal index can be effective in patients with coronary artery disease. In present study we have compared two groups with and without CAD, however in previous studies this index not evaluated in patients under risk factors. Accordingly, the aim of this study was to compare GLS in diabetic and hypertensive patients with significant CAD with diabetic and hypertensive patients without coronary artery disease.

Patients and Methods:***Study setting***

This study conducted on patients with and without CAD who are referred to Ahvaz referral Hospitals, patients were selected from those who had previously undergone coronary angiography at these centers, and the echocardiography procedure for GLS measurement was coordinated.

Study population

20 to 60 years of age patens were enrolled to study, and they were scheduled for Echocardiography. From the 80 enrolled cases, 38 case with CAD as case group, and 42 cases without any coronary condition as control group, have been evaluated.

Inclusion and Exclusion Criteria***Inclusion criteria***

Case group: Diabetic and hypertensive patients with diagnostic criteria for CAD in angiography. As $> 60\%$ stenosis in coronary artery, the presence or absence of vascular stenosis was diagnosed by an experienced cardiologist.

Control group: Diabetic and hypertensive patients referred with normal coronary angiography.

Exclusion criteria,

History of any acquired or congenital heart disease other than DM and HTN or history of heart surgery or any major arrhythmia and conduction disturbance in the heart and individuals with poor quality echocardiographic images were excluded from the study.

Data collection

This as a case-control prospective study conducted on two groups of patients with cardiovascular risk factors, with or without CAD. For this purpose, after the research plan was presented and its implementation processes were approved and the ethical code related to the use of patient information was obtained, sampling of patients began.

In order to sample, after the samples meet the criteria for inclusion in the study were identified, these patients were referred. In this way, after giving the necessary explanations about the plan and the benefits, we have attracted their cooperation in order to participate in the study. 72 patients were selected as the sample size. The desired samples were selected by easy non-random method, in which the most available people were used for sampling.

Measurement of ventricular GLS: Peak systolic strain values in a 17-segment left ventricular model were used to measure GLS. The end of the systole was defined as the closure of the aortic valve in the long-axis apical view. Longitudinal strain was measured in three standard apical four-chamber, apical long-axis and two-chamber planes in two continuous resting cardiac cycles separately for all subjects. The sum of the results of all three Planes was used to calculate the GLS.

Ethical considerations

Study group committed to the principles of ethics introduced by the Health Ministry and the Declaration of Helsinki and legislation in committee of ethics of Ahvaz University of Medical Sciences.

(Ethical code: IR.AJUMS.HGOLESTAN.REC.1399.167)

Statistical analysis

After the data were obtained in the expressed groups, in comparison with these values, paired t-test and independent t-test and Anova, Mann-Whitney, and Levene's Test were used. P Value lower than 0.05 was considered as significant value.

Results:

From 42 patients without CAD and 38 patients with coronary artery disease, the mean and standard deviation of age in patients with CAD was 61.00 ± 8.00 and in the control group was 54.09 ± 10.00 ($P = 0.019$). In patients with CAD, the frequency distribution of male gender was equal to 18 cases (47.0%) and female gender was equal to 20 cases (53.0%) and in control group, male gender was equal to 11 cases (26.0%) and female gender was equal to 31 cases (73.0%) ($P = 0.017$) (Table 1). GLS in CAD cases was 14.00 ± 3.00 and in control cases was 16.00 ± 3.00 , based on statistically evaluation we observed statistically significant difference ($P=0.003$) (Table 2). Also the level of GLS in normal and healthy patients in terms of CAD in two gender types was different, statistically ($P = 0.003$) (table 3). There was a statistically significant relationship between age and gender with GLS, respectively ($P = 0.0001$, 0.046) (Table 4). There is a difference between the amount of GLS in men and women, and it is more in men than in women. The average GLS was 15.09 in women and 16.65 in men.

Discussion:

We observed that there was a statistically significant relationship between GLS and coronary artery involvement in diabetic and hypertensive patients, so this index can be used to evaluate patients, however other studies was evaluated in following. Eshraghi et al. evaluated the echocardiographic GLS on predicting the severity of coronary artery involvement and observed that there was a statistically significant relationship between GLS and the presence or absence of significant coronary artery disease. Accordingly, it has been reported that in cases of suspected coronary artery disease, global myocardial longitudinal stretching on

echocardiography has been a significant independent predictor of CAD (9, 13), which is similar to the results of recent study. Mogensen et al. in a study evaluating the efficiency of GLS in the patients with CAD and observed that GLS score was statistically significantly associated with significant coronary involvement (14), which is consistent with the recent evaluation and demonstrates the effectiveness of using this index to evaluate patients with coronary artery disease.

Gulel et al. also observed that the longitudinal and radial strain parameters of the left ventricle showed non-significant difference of coronary slow flow (CSF) patients and control individuals(6), the results observed in this case were different from the recent assessment, which is due to difference in the evaluated groups in two studies, so that in the recent evaluation of patients with significant CAD and in Gulel study, CSF of patients without coronary stenosis were evaluated, our study group had DM and HTN, which is another reason for this difference. Nurkalem et al. also evaluated patients with CSF in a study and found significant difference in SRs of the two groups, but the rate of systolic TDI and strain in contrast, did not show a significant difference between the two groups. Therefore, they have stated that CSF patients have left ventricular systolic longitudinal dysfunction (12), which is similar to the results observed in a recent evaluation. Seyedian et al. in another study on DM and HTN patients, observed that there was no significant difference in GLS between CSF and normal groups (13.58 ± 5.50 vs. 12.28 ± 7.03 ; $P = 0.489$), also they mentioned that there was not statistically difference in terms of LVEF and LVH ($P < 0.05$). There was no significant difference between GLS in CSF patients and normal coronary arteries in patients with DM and HTN, but GLS itself in these patients compared to GLS in other studies including control group with normal coronary artery and in patients with coronary stenosis without diabetes or HTN was much lower. This difference was observed even in cases with CAD but without DM and HTN, indicating a significant effect of DM and HTN in GLS even without CAD. In present study, we observed significant difference in GLS between control and case groups, both with HTN and DM, due to the presence of CAD. So, most projects have indicated that GLS may be a diagnostic tool in patients with coronary artery disease in association with CAD risk factors.

Conclusion:

Based on present study results, in comparison to some other studies in this field, there was a statistically significant relationship between GLS and coronary artery involvement in DM and HTN patients. Therefore, this index can be used to evaluate Patients benefited.

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Tables:

Table 1. Comparison of age and gender in the two groups

Variables	CAD		P Value
	Positive	Negative	
Age			0.019
Mean	61.00	54.09	
Gender			0.017
Male	(47.0)	11 (26.0)	
Female	(53.0)20	(73.0)31	

Table 2. Comparison of GLS in two groups

GLS	CAD		P Value
	Positive	Negative	
Mean	14.00	16.00	0.003
SD	3.00	3.00	

Table 3. Comparison of GLS levels by gender group

Gender	CAD		P Value
	Positive	Negative	
Male	15.72±3.0	8.18±3.761	0.003
Female	13.45±2.94	16.16±2.81	

Table 4. Statistical comparison between GLS and evaluated indices

Variables	GLS
Age	0.0001
Gender	0.046