Original Article

Association Between Obesity and Global Longitudinal Strain: A Cross-Sectional Study in a University Hospital in Iran

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Abstract

Background: Obesity is a prevalent health issue associated with an increased risk of cardiovascular diseases. While obesity's link to various cardiovascular conditions is well-documented, its specific impact on global longitudinal strain (GLS) requires further investigation. This study aims to explore the relationship between obesity and GLS in an adult population.

Materials and Methods: This cross-sectional study included 91 adult participants, categorized into obese (n=59) and non-obese (n=32) groups based on body mass index (BMI). GLS was measured using speckle-tracking echocardiography. Chi-square tests and odds ratios (OR) were used to assess the association between obesity and abnormal GLS.

Results: Among the non-obese group, 25.0% had abnormal GLS compared to 20.3% in the obese group. The chi-square test indicated no significant difference in the prevalence of abnormal GLS between the groups (p = 0.60). The odds ratio for abnormal GLS in obese versus non-obese participants was 1.3 (95% CI: 0.4-3.6), indicating no significant association.

Conclusion: The study found no significant association between obesity and abnormal GLS, suggesting that BMI alone may not be a reliable predictor of subclinical myocardial dysfunction. These findings highlight the need for a comprehensive approach to cardiovascular risk assessment that includes multiple factors beyond BMI.

Keywords: Obesity, Global longitudinal strain, Myocardial dysfunction, Body mass index, Cardiovascular risk, echocardiography

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Introduction

Obesity is a significant global health issue linked to a variety of cardiovascular diseases (CVDs), such as hypertension, coronary artery disease, and heart failure[1-3]. Global longitudinal strain (GLS), an echocardiographic measure of myocardial deformation, is crucial for assessing cardiac function, particularly in obesity[4-6]. Unlike traditional measures such as ejection fraction, which may remain normal until late in disease progression, GLS can detect early signs of myocardial impairment[6-9]. While many studies have examined the relationship between obesity and different forms of cardiac dysfunction, the specific impact of obesity on GLS remains underexplored[10-12]. The potential mechanisms by which obesity could affect myocardial strain include increased hemodynamic load, metabolic disturbances, and inflammation associated with adipose tissue[13-15]. However, the empirical evidence on this relationship is mixed, necessitating further investigation better to understand the nature and extent of this association.

By comparing the prevalence of abnormal GLS between obese and non-obese individuals, we could determine whether obesity is linked to higher odds of subclinical myocardial dysfunction. Understanding how obesity affects GLS is essential for improving early detection and intervention strategies for cardiovascular risk in obese populations. Thus, this study aims to investigate the relationship between obesity and GLS in an adult cohort.

Methods

Study Design and Population: This cross-sectional study investigated the association between obesity and GLS in a cohort of adult participants referred to a university hospital in Tehran, Iran. A total of 91 participants were recruited from a primary care clinic. Participants were classified into two groups based on their body mass index (BMI): obese (BMI ≥ 30 kg/m²) and non-obese (BMI < 30 kg/m²). The study was approved by the Institutional Review Board of the Shahid Beheshti University of Medical Sciences (IR.SBMU.RETECH.REC.1402.659).

Data Collection: Demographic data, including age and gender, were collected using a structured questionnaire. Clinical measurements were taken during routine medical examinations. GLS was measured using speckle-tracking echocardiography, which provides a detailed assessment of myocardial deformation. GLS values were obtained and averaged from three cardiac cycles for each participant. A GLS value of -18.4 ± 2.0 was considered the normal reference range. Participants with GLS values above this range were classified as having abnormal GLS.

Statistical Analysis: Descriptive statistics were used to summarize the key variables, including mean and standard deviation (SD) for continuous variables (e.g., GLS, BMI). The distribution of GLS (normal vs. abnormal) among obese and non-obese participants was presented as frequencies and percentages. A chi-square test was performed to compare the prevalence of abnormal GLS between obese and non-obese participants. This test evaluated whether there was a statistically significant difference in the distribution of GLS abnormalities between the two groups.

Results

Descriptive Statistics: The study included a total of 91 participants. The mean GLS was -18.4 (SD ± 2.0), and the mean BMI was 34.4 (SD ± 10.3) (Table 1). These descriptive statistics provide a baseline understanding of the general cardiac and physical health of the study population.

Distribution of Abnormal and Normal GLS: Table 2 presents the distribution of abnormal and normal GLS among obese and non-obese participants. Among the non-obese group (n = 32), 25.0% (8 individuals) exhibited abnormal GLS, while 75.0% (24 individuals) had normal GLS. In the obese group (n = 59), 20.3% (12 individuals) had abnormal GLS, and 79.7% (47 individuals) displayed normal GLS. The chi-square test yielded a chi-square value of 0.60, indicating no statistically significant difference ($p > 0.05$). The odds ratio (OR) for having abnormal GLS in obese participants compared to non-obese participants was 1.3 (95% CI: 0.4-3.6). This OR suggests that obesity does not significantly increase the likelihood of having an abnormal GLS.

Table 1. Descriptive Statistics of GLS and BMI**.**

Variables	GLS	BMI
Number	91	91
Mean	-18.4	34.4
Std. Deviation	2.0	10.3

Table 2. Chi-Square Test for Abnormal GLS Between Obese and Non-Obese Groups.

		GLS		Total
		Abnormal	Normal	
Obesity	Non-obese	8 (25.0%)	24 (75.0%)	32
	Obese	12 (20.3%)	47 (79.7%)	59
	Total	20 (22.0%)	71 (78.0%)	91
Chi-Square		0.60		
Odds Ratio		1.3 (CI95%: 0.4-3.6)		

Discussion

Our findings indicate no significant association between obesity and the prevalence of abnormal GLS, suggesting that factors other than BMI may play a more critical role in determining myocardial strain abnormalities. The chi-square test revealed no statistically significant difference in the prevalence of abnormal GLS between obese and non-obese groups. These findings contrast with some previous studies that suggested obesity contributes to myocardial dysfunction via mechanisms such as increased hemodynamic load and adipose tissue-related inflammation.

Several potential explanations exist for the lack of a significant association observed in this study. First, the cross-sectional design limits the ability to capture longitudinal changes in GLS that may be influenced by prolonged exposure to obesity. Second, the sample size, though sufficient for initial analysis, may have been underpowered to detect subtle differences between the groups. Third, other factors such as physical activity, dietary habits, and genetic predispositions, which were not controlled for in this study, could influence GLS independently of BMI.

Implications for Clinical Practice: The findings of this study suggest that while obesity is a known risk factor for cardiovascular diseases, its direct impact on GLS as a measure of subclinical myocardial dysfunction may be less pronounced than previously thought[16-23]. This underscores the importance of a comprehensive approach to cardiovascular risk assessment that includes, but is not limited to, evaluating BMI. Clinicians should consider additional factors and employ various diagnostic tools when assessing cardiac health in obese patients.

Comparison with Previous Research: The relationship between obesity and myocardial strain, specifically global longitudinal strain (GLS), has shown mixed results in the literature. Some studies have found significant associations between increased body mass index (BMI) and impaired GLS. For instance, a study evaluating subclinical left ventricular systolic dysfunction in obese patients found that obese individuals had significantly lower GLS values compared to normal controls, indicating impaired myocardial function due to obesity[11]. Conversely, other studies have not found a significant link between obesity and myocardial strain. Research examining the association of left ventricular strains with various cardiovascular conditions indicated that the relationship between GLS and obesity can be influenced by other factors such as extracellular volume and myocardial fibrosis[24]. Additionally, the impact of obesity on myocardial function may vary depending on the presence of other comorbidities, such as chronic kidney disease, which can independently affect GLS[24]. This inconsistency underscores the need for further research, particularly studies focusing on different population subsets or employing longitudinal designs to understand better the conditions under which obesity might affect myocardial function.

Limitations and Future Research: This study has several limitations that should be acknowledged. The cross-sectional design limits causal inferences, and the small sample size may have constrained the statistical power. Additionally, potential confounders such as physical activity levels, dietary habits, and comorbid conditions were not accounted for. Future research should address these limitations by including larger, more diverse populations and employing longitudinal designs to capture the impact of obesity over time better.

Conclusion

In conclusion, this study found no significant association between obesity and abnormal GLS in a cohort of adult participants. These findings suggest that obesity alone may not be a sufficient predictor of subclinical myocardial dysfunction as measured by GLS. Further research is warranted to explore the complex interplay of factors influencing myocardial strain and develop comprehensive cardiovascular risk assessment and management strategies.

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Conflict of interest

The authors further declare that they have no conflict of interest.

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