Benha Journal of Applied Sciences (BJAS) **print: ISSN 2356–9751**
Vol. (7) Issue (6) (2022), (147-149) **online: ISSN 2356–976x**
http://bjas.journals.ekb.eg

Correlation between Left Atrial Deformation Parameters and Left Atrial Appendage Function in Valvular Heart Disease

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Abstract

Background: In the United States, stroke is the third leading cause of mortality and one of the leading causes of permanent disability. Previous studies have revealed that cardioembolic strokes account for 15–30% of ischemic strokes, making cardiac assessment critical in these individuals.

Low ejection fraction (EF) and severe valvular disease are the most prevalent causes of cardiac embolism. When it comes to determining the cause of cardiac embolism, TEE is the best imaging technique. For the majority of patients, invasive LA function measures aren't an option. TEE data in patients with primary valvular heart disease were used to examine the relationship between the LA functional parameter and the LAA function. Methods: In the cardiology department, a cross-sectional single-center research was conducted. Patients with known valvular heart disease were included in the study. We found that the mean age of the participants in our research was 44.1613.59, and there was no statistically significant difference in the prevalence of hypertension, diabetes, or smoking. It has been shown that the LAA velocity and the LA maximum system strain (r= 0.615; P 0.001), strain rate (r= 0.623) are strongly linked. TDI-derived peak sys strain correlated well with LAA velocity, as did the peak strain rate.

Key words: TDI, left atrial Strain, Strain rate.

1. Introduction

Morbidity and mortality are linked to the loss of LA function in normal populations and in a variety of pathological diseases [1].

It has also been claimed that the LA function may predict future outcomes.

For a variety of disorders include atrial arrhythmia, heart failure, and mitral valve disease, LA function may play an essential role in the assessment process [1].

Several investigations have shown that LA strain has an additional predictive significance in disorders such as AF and mitral valve disease [2, 3].

Aortic valve dysfunction may cause the LA to undergo remodelling, which results in abnormalities in its three functional phases: reservoir, conduit, and booster pump [4].

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For determining the cause of cardiac embolism, transesophageal echocardiography (TEE) is the best imaging technique [5].

However, for the majority of patients, invasive assessments of LA function aren't an option [6].

The use of geometric models to calculate the volume of a nonsymmetric chamber and inaccuracies due to foreshortening restrict the 2D echocardiography assessment of LA volumes.

As a result, when compared to three-dimensional approaches, 2D echocardiography may underestimate LA volumes.

As a result, Doppler study of transmitral and pulmonary vein flow can only tell us so much about the function of the LA [7].

Incorporating Tissue Doppler

In order to forecast the functions of the Left Atrial Appendage (LAA) and the presence of thrombus, imaging is used to determine LA strain / strain rate (SR) [8].

TDI-derived LA functional parameter and LAA function measured with TEE were compared in patients with primary valvular heart disease with the hope of identifying associations.

2. Patients and Methods

2.1. Study design:

This single-center case control study was conducted at Benha University Hospital. It included 200 patients with valvular heart disease and were referred for TEE evaluation.

2.2. Inclusion criteria:

Patients with primary valvular heart disease.

2.3. Exclusion criteria:

- Patients with secondary valvular heart disease.
- Patients with absolute contraindication for TEE: esophageal tumor, stricture, fistula, or perforation, active upper GI bleed, perforated bowel or bowel obstruction, unstable cervical spine, Uncooperative patient.
- Patients with relative contraindication for TEE: Large diaphragmatic hernia, Atlanto-axial disease, extensive radiation to the mediastinum.

For all the patients the following were done:

1. Review of medical history: demographic data (age, sex), risk factors (smoking, DM, and hypertension), history of valvular heart disease, (native).

2. Standard Twelve leads surface ECG: Sinus or atrial fibrillation.
3. Conventional Trans-thoracic Echocardiography: deformation imaging of the left atrium by TDI echocardiography.
4. Trans-esophageal Echocardiography: was performed for evaluation of LAA Velocity, LAA Thrombus, SEC or not.

3.Results:

Age was significantly higher in the thrombus group compared to the non-thrombus group (P value ≤0.001). There was an insignificant difference in hypertension, DM and smoking among the study group.

There was a significant positive correlation between LAA velocity and peak sys strain (r= 0.615, P ≤0.001), and strain rate (r = 0.623, P≤0.001).

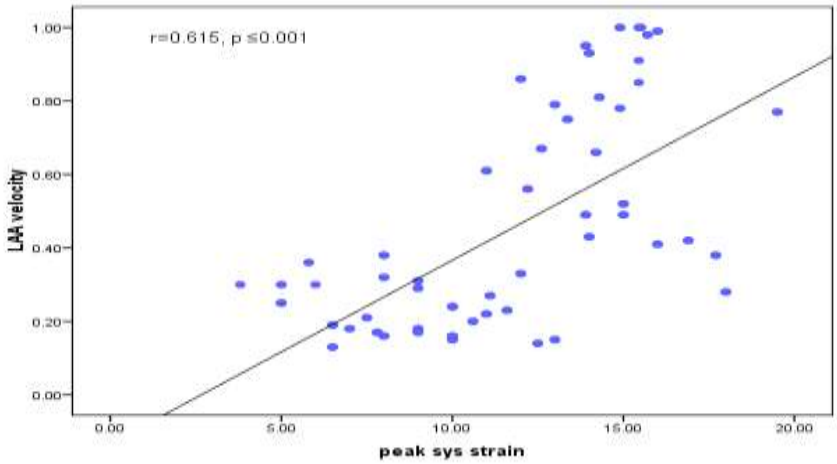

Fig. (1) Scatter diagram for positive correlation between LAA velocity and peak sys strain.

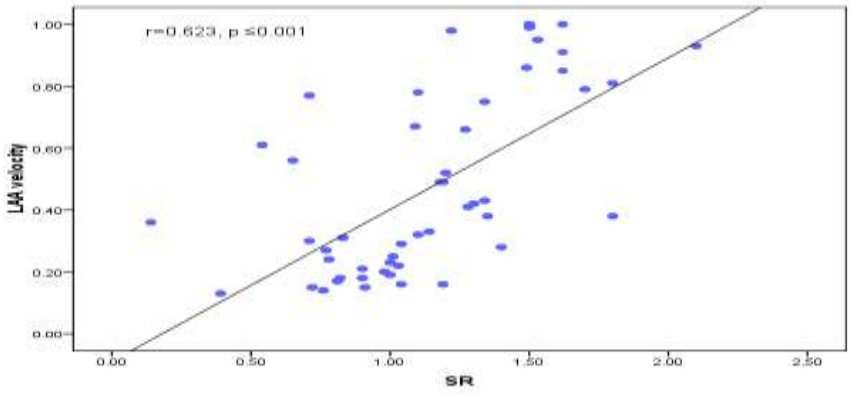

Fig. (2) Scatter diagram for positive correlation between LAA velocity and SR

4. Discussion

The thrombus group had considerably lower LVEF than the non-thrombus group, according to the results of this research (P values = 0.001).

Sasaki et al. [9] found that LVEF was considerably lower in the thrombus group than in the non-thrombus group (P = 0.0001). This is in agreement with our findings.

A study by Wang et al. [10] found that LVEF was considerably lower in the thrombus group than in the non-thrombus group (P = 0.001).

Study participants with thrombus had substantially larger LA diameters than those in the control group (P values 0.001).

Following our findings, Mostafa et al. [12] investigated the predictive validity of left atrial deformation indices in patients with non-functioning left atrial appendage (NVAF).

A total of 250 people with NVAF and a normal left atrial dimension took part in the research.

There was a trans-thoracic and trans-esophageal echocardiogram.

Trans-esophageal and trans-thoracic data were correlated between individuals with and those without thrombus in the LAA (group I vs. group II).

The thrombus group had considerably larger LA diameter than the non-thrombus group (P = 0.137), according to the findings.

By using the same statistical methods as our study, Sasaki et al. [9] found that there were significant differences between the thrombus and control groups in the diameter of the left atrium (LA).

There was a significant difference in the LA dimension between the thrombus and non-thrombus groups (P values 0.001).

There is a strong correlation between our findings and those of Natarajan et al. [12], a prospective

observational single-site investigation, which was undertaken in the cardiovascular department of a tertiary-level interventional cardiac clinic in Gujarat in Ahmedabad.

Rheumatic heart disease patients with mitral stenosis or mitral regurgitation (MS or MR), as well as patients who had had a stroke (ischemic or hemorrhagic) were included in the research, which comprised 120 patients in total.

There was a statistically significant difference between the thrombus and non-thrombus groups in terms of LA dimensions (P values 0.001).

According to the results of this research, thrombus patients had lower LA strain and strain rate (SR) measured by TDI than non-thrombus patients (P values 0.001).

Even more importantly, Sonaglioni et al. [13] found a substantial difference between the thrombus and non-thrombus groups when it came to LA strain and strain rate (SR).

5. Conclusion

There was a significant positive correlation between LAA velocity and peak sys strain & SR derived from TDI.

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