

# Left Atrium Strain and Left Ventricular Diastolic Function in Patients Hospitalized for STEMI

H. Kalkoul<sup>1</sup>, S. Lehachi, M. Chettibi

Cardiology department of Benimessous Hospital, Algiers, Algeria

**Abstract:-** Left ventricular (LV) diastolic dysfunction is a well-established marker for risk stratification of patients with acute myocardial infarction (MI). However, most of the diastolic parameters that were previously assessed were affected by acute hemodynamic changes. The left atrium (LA) strain has been proposed as an alternative approach for LV filling pressure assessment. The main objective of this study is to demonstrate the contribution of LA strain in the assessment of diastolic function 52 patients hospitalized for STEMI, and the result showed there are a significant correlation between LA strain alteration and various parameters: functional class (Killip), LA volume, LV filling pressures.

## I. INTRODUCTION

The left atrium (LA) has an important place in LV filling and overall cardiac performance, as well as a dynamic interaction with ventricular diastole and systole. Atrial dysfunction has been widely considered as a marker or consequence of several cardiac conditions. The LA strain has a major prognostic impact in the short, medium, and long term in all types of cardiovascular disease [1, 2].

- **The main objective** of this study is to demonstrate the contribution of LA strain in the assessment of diastolic function in patients with STEMI.
- **The secondary objectives** are : Correlation between LA strain alteration, functional class, LA volume, Type of STEMI and Culprit vessel.

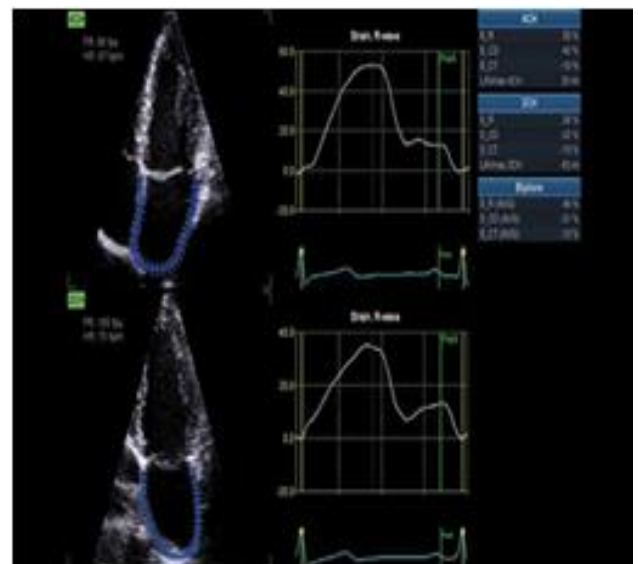
## II. METHOD AND RESULTS

We performed an observational prospective study on 52 patients, hospitalized for STEMI in ICU. Most of our patients were in Killip 1 (92%), and Killip 2 or more in (8%), all in sinus rhythm (100%). On Echocardiography (TTE) : The mean of the ejection fraction (EF) was  $49 \pm 9\%$ , it was preserved in 46%, LV Strain: mean  $11 \pm 5\%$ , impaired in the most cases (96%). The LA was dilated in 50% of cases, and the LA volume was increased in 31% of cases, and LV end-diastolic pressure is elevated (LVEDP) in 29% of cases (type 2: 6%, type 3: 23%). LA strain (Figure1) results: mean reservoir function:  $20 \pm 8$ , impaired in (87%) of cases (normal value NV:  $39 \pm 10$ ) [3], mean conduit phase:  $9 \pm 5$ , impaired in all patients (100%) (NV:  $23 \pm 10$ ) [3], mean contractile function:  $11 \pm 5$ , impaired in 77% (NV:  $23 \pm 10$ ) [3]. Coronary angiography was performed in 73% of patients, the most frequent culprit vessel was the left anterior descending artery (LAD) (81%), one vessel disease

was the most common (49%), followed by multi vessels diseases (29%), and two vessels diseases in (22%) of cases.

The combination of the LA strain with the following parameters showed:

- **The functional class** : 85% of patient in Killip1 had an altered LA strain (mean 20%) and 100% of Killip2 had a very altered LA strain (mean 15%) ( $p < 0.05$ ) (Figure 2).
- **LA volume** : there are a significant correlation between LA volume and LA strain alteration ( $p < 0.05$ ) (Figure 3).
- **Left ventricular end-diastolic pressure (LVEDP)** : There are 81% of patients with non-elevated LVEDP had a low reservoir LA strain (mean 20%) and 100% of patients with elevated LVEDP (type 2 and 3) had a very impaired LA strain ( $p < 0.05$ ) (Figure 4).
- **Coronary anatomy** : LA strain is more impaired in anterior STEMI (96% of cases) with tritruncular lesions (91% of cases).



**Fig 1.** Example of Left atrial Speckle tracking echocardiography of patient hospitalized for STEMI in the ICU of BeniMessous Hospital Algiers, Algeria.

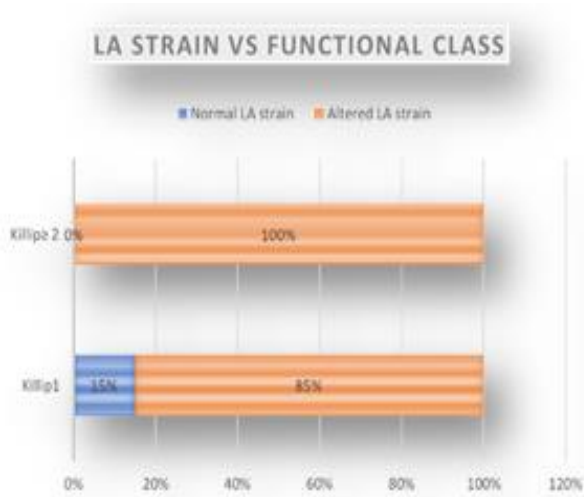


Fig 2. Correlation between LA strain and functional class

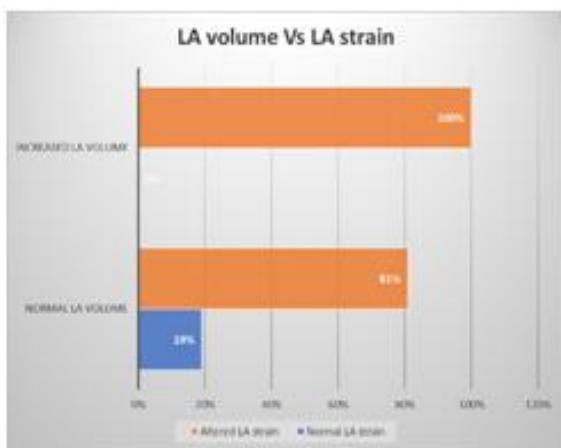


Fig 3. Correlation between LA volume and LA strain.

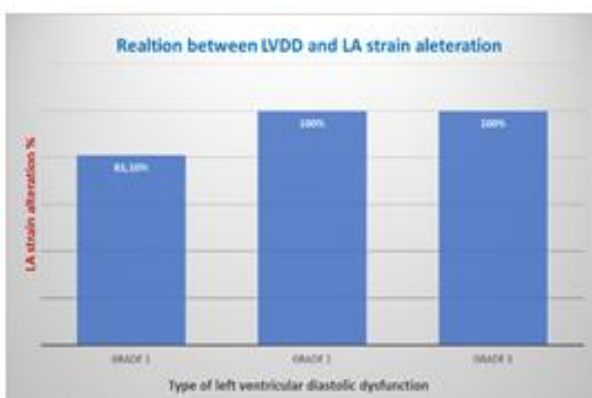


Fig 4. Corelation between type of LVEDP and LA strain alteration

III. DISCUSSION

- It has been reported that after STEMI, an increase in LV end-diastolic pressure (LVEDP) induces higher LA afterload and thus mechanical stress on the atrium, resulting in higher LA volumes, and reduced LA emptying [1, 2] (as confirmed in our study).
- Left ventricular diastolic dysfunction usually precedes systolic dysfunction in the initial phase after STEMI (our study also showed that patients with preserved EF,

asymptomatic and normal filling pressures had an altered LA strain) [2, 4]. It is therefore a sensitive and early parameter.

- Our study showed a significant correlation between LA strain alteration and various parameters : functional class (Killip), LA volume, LV filling pressures.
- Recent studies of heart failure after myocardial infarction have reported that LA reservoir function is the most affected, with better diagnostic accuracy for diastolic function and filling pressures than maximum LA volume [4, 5, 6].
- These findings are in line with those of our own study, in which reservoir function was affected in 87% cases.
- However, LA volume is a non-sensitive predictor of the early stages of LVEDP. Our study showed altered LA strains even in patients with normal LA volume (81 %).

IV. CONCLUSION

Left ventricular diastolic dysfunction (LVDD) usually precedes systolic dysfunction in the early phase after acute myocardial infarction (MI). The atrial function is often affected in STEMI where the Strain LA has an important and powerful value for its assessment.

REFERENCES

- [1]. Ricardo Fontes-Carvalho et al. Rev Port Cardiol.2018;37:821-3010.1016/j.repece.2017.10.015
- [2]. Cameli M, Mandoli GE, Loiacono F, Dini FL, Henein M, Mondillo S. Left atrial strain: a new parameter for assessment of left ventricular filling pressure. Heart Fail Rev. 2016 Jan;21(1):65-76. doi: 10.1007/s10741-015-9520-9. PMID: 26687372.
- [3]. Nielsen AB, Skaarup KG, Hauser R, Johansen ND, Lassen MCH, Jensen GB, Schnohr P, Møgelvang R, Biering-Sørensen T. Normal values and reference ranges for left atrial strain by speckle-tracking echocardiography: the Copenhagen City Heart Study. Eur Heart J Cardiovasc Imaging. 2021 Dec 18;23(1):42-51. doi: 10.1093/ehjci/jeab201. PMID: 34632487.
- [4]. Ahmeti A, Bytyçi FS, Bielecka-Dabrowa A, Bytyçi I, Henein MY. Prognostic value of left atrial volume index in acute coronary syndrome: A systematic review and meta-analysis. Clin Physiol Funct Imaging. 2021 Mar;41(2):128-135. doi: 10.1111/cpf.12689. Epub 2021 Jan 12. PMID: 33372377; PMCID: PMC7898886.
- [5]. Singh A, Addetia K, Maffessanti F, Mor-Avi V, Lang RM. LA Strain for Categorization of LV Diastolic Dysfunction. JACC Cardiovasc Imaging. 2017 Jul;10(7):735-743. doi: 10.1016/j.jcmg.2016.08.014. Epub 2016 Dec 21. PMID: 28017389; PMCID: PMC5741456.
- [6]. -Thomas et al. Left Atrial Metrics and Diastolic Dysfunction J A C C V O L . 7 3 , N O . 1 5 , 2 0 1 9