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The Relation between Left Atrial Strain Parameters and Short-Term Adverse Outcomes in Patients Admitted with Acute Decompensated Heart Failure

ADHAM A. ABDELTAWAB, M.D.; MENNATULLAH M. ABDELMAKSOUD, M.Sc.;
KHALED A. EL MENYAWI, M.D. and ISLAM M. BASTAWY, M.D.

The Department of Cardiology, Faculty of Medicine, Ain Shams University

Abstract

Background: Heart failure (HF) is a complex and fatal medical entity with high morbidity and mortality, Patients with HF have poor prognoses. Hospitalization for acute heart failure has a poor vital prognosis, with frequent subsequent readmissions **[1]**.

Aim of Study: Determine the relation between left atrial strain and MACE during hospitalization and 3 months post discharge in patients admitted with acute decompensated heart failure.

Patients and Methods: This was a prospective observational study that included 90 patients hospitalized with acute heart failure where full history, clinical examination, and 2D transthoracic echocardiography with assessment of left atrial strain parameters were done to all patients, then patients were assessed for short term outcomes.

Results: The mean ± SD age of our patients was 60.3±9.5 years. Seventy percent were males. Regarding Outcome follow-up (3 months) data; mortality occurred in 12.2% of patients, 55.6% needed re-admission, 46.7% had atrial fibrillation, and 40% had stroke. Different left atrial strain parameters were significantly associated with mortality, rehospitalization, incidence of atrial fibrillation and stroke.

Conclusion: Our study had proven that LA strain parameters (LA reservoir strain, LA contractile strain), had a significant prognostic value in predicting mortality, rehospitalization, and incidence of atrial fibrillation in acute decompensated heart failure patients. So, 2D speckle tracking echocardiography had a particular importance in acute heart failure prognosis prediction.

Key Words: *Left atrial strain – Acute heart failure – MACE – Rehospitalization – Outcomes.*

Introduction

THE pathophysiological contribution and prognostic impact of left atrial (LA) mechanics in heart failure are often underappreciated. More than solely being a passive extension of the left ventricle, the left atrium can be regarded as a dynamic continuum of the left ventricle with a principal role of ensuring left ventricular (LV) filling and cardiac performance by its reservoir, conduit, and booster pump function. This 3-phase role depends not only on LV diastolic and systolic function, but also on intrinsic LA properties. As such, any alteration in ventricular performance or loading condition may affect the interdependence between the left atrium and the left ventricle. To date, few studies have assessed the effect of congestion and decongestive therapy on LA mechanics **[2]**.

Echocardiography-derived parameters can be used to estimate the left atrial pressure (LAP) non-invasively. Indices that have been proposed include interrogation of the transmitral left ventricular (LV) filling pattern (E/A ratio, E wave deceleration time, and the isovolumic relaxation time), pulmonary venous Doppler diastolic deceleration time, M-mode color Doppler propagation velocities, the time interval between the onset of early diastolic mitral inflow (E) and annular early diastolic velocity (e') by tissue Doppler imaging, and the E/e' ratio) **[3]**.

New specific parameters for assessment for LAP have been recently introduced including left atrial strain indices as LA reservoir strain, LA conduit strain, LA contractile strain **[4]**.

Left atrial dysfunction can be associated with left ventricular (LV) disorders; however, its clinical significance has not been well-studied in patients with acute heart failure (AHF) **[2]**.

Aim of the study:

Determine relation between left atrial strain and MACE during hospitalization and 3 months post discharge in patients admitted with acute decompensated heart failure.

Correspondence to: Dr. Adham A. Abdeltawab,
The Department of Cardiology Faculty of Medicine,
Ain Shams University

Patients and Methods

This was a prospective observational study that included 90 patients hospitalized with acute heart failure. The study started in January 2023 and continued until August 2023. The study was conducted at the Cardiology Department at Ain Shams University Hospital.

The study was approved by the ethical committee with proper patient confidentiality respected and proper informed consent.

We included patients older than 18 years old with acute decompensated heart failure (left ventricle ejection fraction [LVEF] <40% as per European Society of Cardiology 2021 guidelines) **[5]**. Patients with acute myocardial infarction and with atrial fibrillation were excluded.

All included patients were subjected to the following:

1- Detailed history taking with demographics and with special emphasis on (New York Heart Association) NYHA functional classification **[1]**.
2- Full clinical examination.
3- Investigation:
 - Laboratory investigation including CBC, urea & creatinine, AST & ALT, serum sodium and serum potassium levels and troponin I were done.
 - Two-dimensional (2D) speckle tracking echocardiography (STE).

Apical four and two chamber view images of the LA were obtained using conventional 2-dimensional echocardiography, at relatively high frame rates (60–80 fps). The LA endocardium was traced in both four and two chamber views and the region of interest (ROI) was adjusted to the thinner wall of the atrium.

In regions of discontinuities of the LA wall, such as areas corresponding to pulmonary veins and LA appendage, extrapolation of the LA endocardial and epicardial surfaces at the junction of these structures was performed to obtain the ROI. The ROI was divided into six segments and the total of 12 segments were analyzed with the software generating the individual segmental longitudinal strain curves together with global strain in each view. Also, software was used to measure peak atrial longitudinal strain (PALS) or LA systolic strain and peak atrial contraction strain (PACS) or late diastolic strain **[4]**.

4- Patient were discharged when there were no more signs of decompensation.

MACE (All-cause mortality, readmission, incidence of atrial fibrillation, incidence of cerebrovascular stroke) were recorded for patients during admission and during the 3 months after discharge.

Statistical analysis and statistical package:

The data was treated on compatible personal computer using the statistical package for Social Sciences (SPSS-version 21). Description of quantitative variables was in the form of mean, standard deviation (SD), minimum and maximum. Description of qualitative variables was in the form of numbers (No.) and percentages (%). The data was described using the suitable measures for central tendency and dispersion as well as percentage as indicated. *t*-tests was used for continuous variables and was expressed as means ± SD.

Relation between qualitative variables was carried out by Chi-squared test to determine the relationship between two or more classification factors.

Pearson correlation, multivariate linear regression test and ROC curve were used to assess the correlation between different variables. All statistical tests were 2-tailed; statistical significance was set at $p \leq 0.05$.

Results

This was a prospective observational study conducted on 90 patients with acute heart failure (HF), to assess the short-term prognostic value of left atrial strain.

Descriptive data:

The mean ± SD age of all patients was 60.3±9.5 years. Regarding gender of the patients, the majority (70%) of patients were males, while 30% were females.

Table (1): Comorbidities and baseline clinical data.

Variables	Frequency (%)/ Mean ± SD
HTN	44 (48.9%)
DM	52 (57.8%)
Previous MI	54 (60%)
CKD	35 (38.9%)
Smoking	62 (68.9%)
BMI	26.4±2.9
HR (beat/min)	81.2±17.2
SBP (mmHg)	102.7±12.7
DBP (mmHg)	67.2±7.3
MABP (mmHg)	79±8.7
HF onset:	
(Acute on top of chronic)	45 (50%)
(De novo)	45 (50%)

HTN: Hypertension. HR : Heart rate.
DM : Diabetes mellitus. HF : Heart failure.
MI : Myocardial infarction. SBP : Systolic blood pressure.
CKD: Chronic kidney disease. DBP: Diastolic blood pressure.
BMI : Body mass index. MABP: Mean arterial blood pressure.

Echocardiographic data:

LAVI was higher than normal; 36.9±10.3 vs <29ml/m^2, while LA reservoir, conduit and contractile strain were lower (Table 2) [6].

Patients in our study showed impairment in all strain parameters (LA conduit strain, contractile strain and reservoir strain) with dilated left atrial volume index. LV diameters were dilated with impaired LV systolic function and diastolic function parameters.

Table (2): Shows the Echocardiographic data in patient groups.

Variables	Mean	SD
EF (%)	30.52	8.84
LVEDD (mm)	57.36	9.07
LVED vol	154.7	55.04
LVESD (mm)	46.42	8.88
LVES vol	103.78	48.15
LV wall thickness (mm)	9.68	2.57
E (m/s)	0.76	0.25
A (m/s)	0.67	0.22
E/A	1.31	0.83
DT (cm/s)	167.63	54.94
Septal E (cm/s)	0.11	0.43
Lateral E (cm/s)	0.087	0.14
E/e	15.88	9.25
LA vol ml^3	62.38	16.63
LAVI (normal value <29 ml/m^2) [6]	36.92	10.31
LA reservoir strain (mean normal value 39.4) [6]	14.41	7.45
LA conduit strain (mean normal value -23.0) [6]	-7.22	3.97
LA contractile strain (mean normal value -17.4) [6]	-7.38	5.63

LVEDD: Left Ventricular End-Diastolic Diameter.
LVESD: Left Ventricular End-Systolic Diameter.
LVFS : Left ventricular fractional shortening.
EF: Ejection Fraction. LA: left atrial.

Outcome data:

Regarding outcome follow-up (3 months) data 12.2% of patients died, 55.6% needed hospital re-admission, 46.7% had AF, and 40% had stroke (Table 3).

Table (3): Outcome follow-up (3 months).

Variables		Frequency (%)
All-cause mortality rate	+ve	11 (12.2%)
Re-admission rate	+ve	50 (55.6%)
AF	+ve	42 (46.7%)
Stroke	+ve	36 (40%)

AF: Atrial fibrillation.

Correlation studies:

Correlation studies were sought between different 3-months outcomes; and its relative independent predictors (baseline clinical, Echocardiographic, laboratory, treatment variables) conducted with logistic regression analysis, Pearson's correlation coefficient and ROC curve analysis (as suitable).

Logistic regression analysis showed that; after applying (Forward method) and entering some predictor variables; the increase in LVES volume and LA contractile strain; had an independent effect on increasing the probability of mortality occurrence; with significant statistical difference (p<0.05 respectively) (Table 4).

Table (4): Logistic regression model for the Factors affecting mortality occurrence using Forward method (out of 11 mortality cases).

Predictor Factor	Coefficient	OR	*p*-value
(Constant)	–0.11115		
LVES vol	0.014300	1.0144	0.049* (S)
LA contractile strain	0.41393	1.5128	0.014* (S)

Other factors excluded from the model as (p-value >0.1).
OR: Odds ratio.

Logistic regression analysis showed that; after applying (Forward method) and entering some predictor variables; the increase in CKD, E, LAVI, and LA contractile strain; had an independent effect on increasing the probability of Re-admission occurrence; with significant statistical difference (p<0.05 respectively).

Logistic regression analysis showed that; after applying (Forward method) and entering some predictor variables; the decrease in E/A and Lateral E; had an independent effect on increasing the probability of Re-admission occurrence; with significant statistical difference (p<0.05 respectively) (Table 5).

Table (5): Logistic regression model for the Factors affecting Re-admission occurrence using Forward method.

Predictor Factor	Coefficient	OR	*p*-value
(Constant)	–10.73293		
CKD	12.96184	4.26003	0.001**
E	20.78062	1.06009	0.003**
E/A	–11.73286	0.068	0.0005**
Lateral E	–12.37686	0.062	0.014*
LAVI	0.40597	1.5008	0.019*
LA contractile strain	0.38000	1.4623	0.014*

Other factors excluded from the model as (p-value >0.1).
OR : Odds ratio.
CKD: Chronic kidney disease.
LAVI: Left atrial velocity index.
LA : Left atrial.

Logistic regression analysis showed that; after applying (Forward method) and entering some predictor variables; the increase in LVEDD and LA contractile strain; had an independent effect on increasing the probability of AF occurrence; with significant statistical difference (p<0.05 respectively).

Logistic regression analysis showed that; after applying (Forward method) and entering some predictor variables; the decrease in LVESD and E/A; had an independent effect on increasing the probability of AF occurrence; with significant statistical difference (p<0.05 respectively) (Table 6).

Table (6): Logistic regression model for the Factors affecting AF occurrence using Forward method.

Predictor Factor	Coefficient	OR	p-value
(Constant)	–1.15556		
LVEDD	0.49446	1.6396	0.0004**
LVESD	–0.50713	0.6022	0.0013**
E/A	–2.23000	0.1075	0.0004**
LA contractile strain	0.24086	1.2723	0.013*

Other factors excluded from the model as (p-value >0.1).
OR: Odds ratio.
LVEDD: Left ventricular end diastolic diameter.
LAESD: Left ventricular end systolic diameter.
LA: Left atrial.

Logistic regression analysis showed that; after applying (Forward method) and entering some predictor variables; the increase in LAVI; had an independent effect on increasing the probability of Stroke occurrence; with significant statistical difference (p<0.05).

Logistic regression analysis showed that; after applying (Forward method) and entering some predictor variables; the decrease in LVESD; had an independent effect on increasing the probability of Stroke occurrence; with significant statistical difference (p<0.05) (Table 7).

Table (7): Logistic regression model for the Factors affecting Stroke occurrence using Forward method.

Predictor Factor	Coefficient	OR	p-value
(Constant)	–0.54145		
LVESD	–0.069093	0.9332	0.028*
LAVI	0.088962	1.0930	0.0017**

Other factors excluded from the model as (p-value >0.1).
OR: Odds ratio.

Comparative studies regarding left atrial strain parameters:

The 90 HF patients were classified according to mortality into two independent groups:

- Mortality group.
- Survived group.

Comparative study between the 2 groups revealed: highly significant increase in LA contractile strain, in mortality group (p=0.001), and highly significant decrease in LA reservoir strain, in mortality group (p=0.001) with no significant difference as regards conduit strain (Table 8).

Table (8): Comparison between the 2 Mortality groups as regards left atrial strain parameters using Student's t-test.

Variable	Mortality group (n=11) Mean t SD	Survived group (n=79) Mean t SD	Student's t-test p-value
LA reservoir strain	7.5t6	15.3t7.1	= 0.001** (HS)
LA conduit strain	–5.4t3.2	–7.4t4	= 0.116 (NS)
LA contractile strain	–2.1t2	–8.1t5.5	= 0.001** (HS)

The 90 HF patients were classified according to Re-admission into two independent groups:

- Re-admission group.
- Non-readmission group.

Comparative study between the 2 groups revealed non-significant difference as regards left atrial strain parameters (p>0.05) (Table 9).

Table (9): Comparison between the two Re-admission groups as regards left atrial strain parameters using Student's t-test.

Variable	Re-admission group (n=50) Mean t SD	Non-Readmission group (n=40) Mean t SD	Student's t-test p-value
LA reservoir strain	14.6t7.3	14.1t7.6	= 0.768 (NS)
LA conduit strain	–7.5t3.8	–6.7t4.1	= 0.343 (NS)
LA contractile strain	–6.9t5.6	–7.9t5.6	= 0.381 (NS)

The 90 HF patients were classified according to AF into two independent groups:

- AF group.
- Non-AF group.

Comparative study between the two groups revealed: Highly significant increase in LA contractile strain, and highly significant decrease in LA reservoir strain, in AF group. No significant difference as regards LA conduit strain between groups (Table 10).

Table (10): Comparison between the two AF groups as regards left atrial strain parameters using Student's t-test.

Variable	AF group (n=42) Mean t SD	Non-AF group (n=48) Mean t SD	Student's t-test p-value
LA reservoir strain	9.6t6.7	18.5t5.2	<0.001** (HS)
LA conduit strain	–6.5t2.7	–7.7t4.7	= 0.147 (NS)
LA contractile strain	–3.5t4.1	–10.7t4.5	<0.001**(HS)

The 90 HF patients were classified according to stroke into two independent groups:

• Stroke group.

• Non- Stroke group.

Comparative study between the 2 groups revealed no significant difference as regards left atrial strain parameters (*p*>0.05) (Table 11).

Table (11): Comparison between the two Stroke groups as regards left atrial strain parameters using Student's *t*-test.

Variable	Stroke group (n=36) Mean ± SD	Non- Stroke group (n=54) Mean ± SD	Student's *t*-test *p*-value
LA reservoir strain	13.2±7.9	15.1±7.1	= 0.241 (NS)
LA conduit strain	–7±3.1	–7.3±4.4	= 0.707 (NS)
LA contractile strain	–6.1±5.2	–8.1±5.7	= 0.101 (NS)

ROC curve analysis to predict 3-months outcomes:

By using ROC-curve analysis, LA reservoir strain at a cutoff point (≤8) predicted patients with mortality, with good accuracy 80%, sensitivity= 81% and specificity=77% (*p*<0.01) (Table 12) (Fig. 1).

By using ROC-curve analysis, LA contractile strain at a cutoff point (>-4) predicted patients with mortality, with good accuracy 80%, sensitivity= 90% and specificity=70% (*p*<0.01) (Table 12) (Fig. 2).

By using ROC-curve analysis, LA conduit strain, showed no significant predictive values regarding mortality (*p*>0.05) (Table 12).

By using ROC-curve analysis, LA reservoir strain at a cutoff point (≤15) predicted patients with AF, with good accuracy 84%, sensitivity=85% and specificity=83% (*p*<0.01) (Table 13).

By using ROC-curve analysis, LA contractile strain at a cutoff point (>-3) predicted patients with AF, with good accuracy 88%, sensitivity=66% and specificity=100% (*p*<0.01) (Table 13).

By using ROC-curve analysis, LA conduit strain showed non-significant predictive values regarding AF (*p*>0.05) (Table 13).

By using ROC-curve analysis, left atrial strain parameters showed non-significant predictive values regarding stroke (*p*>0.05) (Table 13).

By using ROC-curve analysis, left atrial strain parameters showed non-significant predictive values regarding Re-admission (*p*>0.05) (Table 13).

Table (12): Roc-curve of left atrial strain parameters to predict patients with mortality.

Variable	AUC	Best Cut off point (Criterion)	Sensitivity (%)	Specificity (%)	*p*-value
LA reservoir strain	0.801	≤8	81.82	77.22	<0.0001** (HS)
LA conduit strain	0.645	>-8	81.82	56.96	0.0845 (NS)
LA contractile strain	0.800	>-4	90.91	70.89	<0.0001**(HS)

ROC (Receiver operating characteristic), AUC = Area under curve.

Table (13): Roc-curve of left atrial strain parameters to predict patients with AF.

Variable	AUC	Best Cut off point (Criterion)	Sensitivity (%)	Specificity (%)	*p*-value
LA reservoir strain	0.846	≤15	85.71	83.33	<0.0001** (HS)
LA conduit strain	0.584	>-12	100	27.08	0.1795 (NS)
LA contractile strain	0.883	>-3	66.67	100	<0.0001** (HS)

ROC (Receiver operating characteristic), AUC = Area under curve.

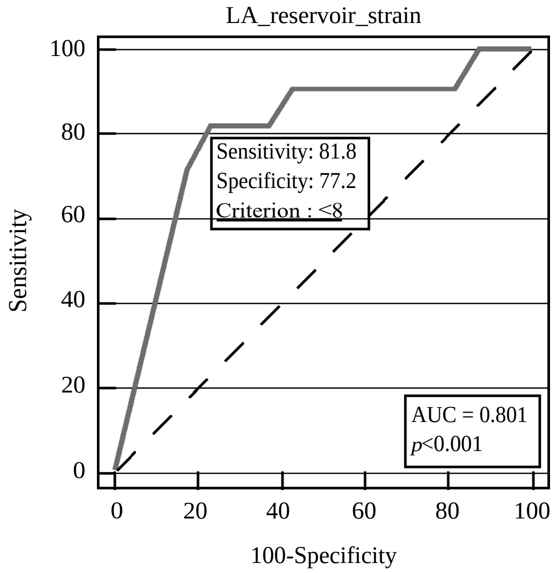

Fig. (1): ROC curve of LA reservoir strain (mortality).

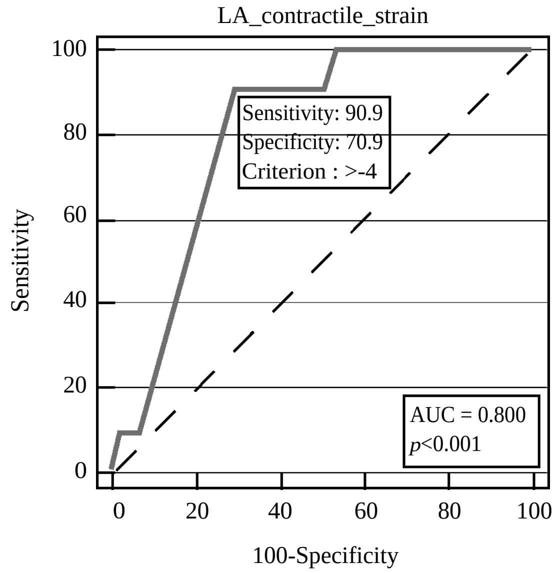

Fig. (2): ROC curve of LA contractile strain (mortality).

Discussion

LA strain in patients with new onset dyspnea may be extremely useful for a correct diagnosis of HF and for the demonstration of a possible reversibility of LA dysfunction and symptoms with therapy **[4]**.

This was a prospective observational study conducted on 90 patients with acute decompensated heart failure (HF); to determine association between left atrial strain and MACE during hospitalization and 3 months post discharge.

The mean age of our patients was 60.3±9.5 years. Seventy percent of our patients were males.

During hospital stay and after a follow-up period of 3 months, 12.2% of patients died, 55.6% needed re-admission, 46.7% had new onset AF, and 40% had new cerebrovascular stroke.

Freed et al., assessed the prognostic utility and clinical significance of cardiac mechanics in heart failure and importance of left atrial strain, and reported that, during the follow-up period, 94 patients (31%) were hospitalized for a cardiovascular reason, 66 (21%) were hospitalized for HF, 37 (12%) died, and 115 (37%) experienced the composite end point of cardiovascular hospitalization (including HF hospitalization) or death **[7]**.

Carluccio et al., studied determinants and prognostic impact of LA reservoir function in patients with HF, and reported that, during follow-up, 139 (34%) patients reached the primary end point (66 deaths and 73 HF rehospitalizations) **[8]**.

Jia et al., systematically assessed the prognostic value of PALS for adverse events in HF, and reported in their meta-analysis that, among 7,787 patients in 17 included studies, 3,029 (38.9%) experienced the primary endpoint **[9]**.

Barki et al., defined the clinical trajectory of LA mechanics by left atrial strain (LAS) analysis in acute heart failure, and reported that, at 1-year FU, the primary endpoint occurred in 24 patients (28.2%), with 16 patients (16.5%) re-hospitalized for AHF; seven deaths for CV reason (8.2%), one patient undergoing mitral valve replacement for severe chronic MR **[10]**.

Maffeis et al, sought to examine predictability of exercise capacity in 171 patients with CHF using LAS independently of LVEF. Their sample age was 65±11 years and included 136 males (80%) **[11]**.

Park et al, evaluated prognostic power of peak atrial longitudinal strain (PALS) of the left atrium according in a registry of 4312 patients, where they analyzed PALS in 3818 patients **[12]**.

Chang et al., investigated the survival predictive value of left atrial strain in 652 participants who received routine echocardiography underwent 2-D speckle tracking echocardiography to evaluate left atrial reservoir function by peak atrial longitudinal strain and recorded different endpoints **[13]**.

Kaler et al., aimed to determine the relationship between predischarge PALS and NT-proBNP as predictors of major adverse cardiac event (MACE) in patients after AHF hospitalization. They included 67 patients with AHF with varying degrees of LVEF where over the 90-day follow-up period, 21 patients (31.3%) encountered MACE *[14]*.

Cameli et al., aimed to use left atrial strain for assessment of left ventricular filling pressures *[4]*.

Park et al., aimed to identify whether left atrial strain was a predictor of new-onset atrial fibrillation in patients with heart failure or not and included 2461 patients out of 4,312 consecutive patients with acute HF from 3 tertiary hospitals with sinus rhythm *[15]*.

Yamamoto et al., assessed prognostic impact of left atrial strain in patients hospitalized for acute heart failure with atrial fibrillation. They conducted their study on a total of 320 patients (mean age 79±12 years, 163 women) with a median follow-up of 473 days, where 92 cardiovascular deaths and 113 all-cause deaths occurred *[16]*.

In our study left atrial strain parameters showed non-significant predictive values regarding stroke.

The increase in LAVI had a significant independent effect on increasing the probability of cerebrovascular stroke occurrence.

The decrease in LVESD also had a significant independent effect on increasing the probability of cerebrovascular stroke occurrence.

Krittayaphong et al., aimed to determine the prognostic value of left atrial strain (LAS) using cardiac magnetic resonance for predicting death, heart failure, and ischemic stroke in 2030 patients with known or suspected coronary artery disease with preserved left ventricular systolic function and no prior history of ischemic stroke, heart failure, or atrial fibrillation. They reported in their study 49 deaths (2.4%), 32 ischemic strokes (1.6%), and 34 heart failure events (1.7%) *[17]*.

We found in our study a highly significant positive correlation between LA contractile strain and a significant negative correlation between LA reservoir strain, and mortality. The increase in LVES vol and LA contractile strain had an independent effect on increasing the probability of mortality. This could be explained by increased filling pressures conveying poor left ventricular performance, recovery and outcomes.

LA reservoir strain > -4 predicted patients with mortality, with good accuracy, sensitivity=90% and specificity=70%. LA reservoir strain was worse in the mortality group and the cutoff point <8 could predict mortality with good accuracy.

Our data regarding correlation with mortality came in agreement with Freed et al., Carluccio et al., Jia et al., and Barki et al., *[7-10]*.

Our ROC-curve analysis regarding mortality prediction came in alignment with Carluccio et al., Park et al., Jia et al., Maffeis et al., Chang et al., and Kaler et al., *[8,9,11-14]*.

LA contractile strain was also found to be an independent predictor of re-admission.

There was a statistically significant increase in LA contractile strain and a statistically significant decrease in LA reservoir strain, in group of patients in whom AF occurred. The increase in LVEDD and LA contractile strain; had an independent effect on increasing the probability of AF occurrence. This could be explained by deranged left atrial mechanics that mostly occur prior to occurrence of AF.

LA reservoir strain at a cutoff point <15 predicted occurrence of AF, with sensitivity=85% and specificity=83%. LA contractile strain at a cutoff point >-3 predicted occurrence of AF, with sensitivity=66% and specificity=100%.

In Jia et al., reported in their meta-analysis that, patients with events had lower PALS than those without events. Each unit increment of PALS was independently associated with decreased risk for the primary endpoint *[9]*.

Barki et al., reported that, in acute heart failure (AHF), irrespective of the underlying LVEF, a thorough left atrial strain (LAS) analysis is predictive of early re-hospitalization and cardiovascular outcome over time and would allow to identify specific phenotypes at risk *[10]*.

On the other hand, they explained the lack of improvement in LAS from admission to discharge by a lack of full resolution of subclinical tissue oedema affecting LA load *[10]*.

In Carluccio et al. study reported that PALS was also significantly associated with an increased risk of the composite end point in unadjusted analysis *[8]*.

Carluccio et al., observed a significant correlation between PALS and GLS (global longitudinal strain), supporting that the more advanced LV longitudinal dysfunction, the more impaired is LA reservoir function *[8]*.

They concluded that, in patients with HF, LA reservoir strain was strongly associated with estimated elevated filling pressure, impaired LV and

RV systolic function, and independently associated with increased risk of the composite end point of HF hospitalization or all-cause death [8].

The relationship between PALS and LV-GLS in their study did not ablate the independent prognostic value of LA strain where in patients with HF the LA reservoir strain remained independently associated with the composite outcome of cardiovascular hospitalization or death, even after adjustment for GLS [8].

Park et al., showed PALS to be a significant predictor of events. Patients with the lowest tertile had a higher number of events than those with the highest tertile in the multivariate analysis [12].

Jia et al., also reported in their meta-analysis that, peak atrial longitudinal strain was an independent predictor for all-cause mortality and cardiac hospitalization in patients with HF [9].

Because individual patient data from original studies were not available, they couldn't define the cutoff value of PALS for identifying high-risk patients and its diagnostic accuracy in ROC curves [9].

Maffeis et al., suggested in their study that the value added by LA reservoir strain was highly relevant in patients with normal LAVi and with mildly dilated LA. In fact, when LA is moderately to severely dilated, also LA strain is usually reduced, supporting the notion that LA dysfunction is more sensitive and discriminative than structural parameters [11].

Chang et al., study concluded that, reduced LA strain was significantly associated with increased all-cause and CV mortality in a multivariable Cox regression analysis [13].

Kaler et al., study concluded that, PALS could forecast major adverse cardiac event (MACE) was identified as <12%, yielding an area under the curve (AUC) of 0.816 [14].

The role of left atrial strain in predicting MACE is linked to its ability to quantify left atrial (LA) reservoir function representing the physiological response to elevated left ventricular end-diastolic pressure (LVEDP) across heart failure syndromes [14].

Cameli et al., reported that PALS decreased with reducing systolic and diastolic function in patients with ST elevation acute myocardial infarction (STEMI) treated with percutaneous coronary intervention with tendency to improve in patients who undertake cardiac rehabilitation [4].

Our ROC-curve analysis regarding mortality prediction came in alignment with Park et al., and Yamamoto et al. [15,16].

Park et al., 2020 study reported that, in patients with HF and sinus rhythm, 16.1% developed AF within 5 years. Where the peak atrial longitudinal strain (PALS) could be used to predict the risk for AF [15].

Yamamoto et al., reported a significant association between LA reservoir strain (LARS) and death in patients with AF and HF. Patients with reduced LARS had poor prognosis, suggesting the need for aggressive therapy to improve their LA dysfunction [16].

Krittayaphong et al., found in their study that patients with LAS <23% were at greater risk for composite outcomes [17].

Barki et al., concluded that LA dynamics was highly predictive of re-hospitalization and cardiovascular outcome in acute HF and allowed to ease risk-stratification, which made it an early reference target for improving long-term outcome [10].

Conclusion:

Our study had proven that LA strain parameters (LA reservoir strain, LA contractile strain), had a significant prognostic value in predicting mortality and adverse effects (e.g. AF), in acute heart failure patients. So, 2D speckle tracking echocardiography had a particular importance in acute decompensated heart failure prognosis prediction.

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العلاقة بين قياسات إجهاد الأذين الأيسر والنتائج السلبية قصيرة المدى لدى المرضى الذين يتم إدخالهم مصابين بفشل حاد فى عضلة القلب

فشل عضلة القلب هو مرض معقد ومميت مع معدلات عالية للوفيات وحدوث المضاعفات.

يحمل دخول المرضى للمستشفى بفشل عضلة القلب احتمالية كبيرة لاعادة الدخول مرة أخرى وحدوث عدة مضاعفات.

وكانت هذه الدراسة تهدف الى تحديد الارتباط بين قياسات اجهاد الأذين الأيسر وحدوث الوفيات والنتائج السلبية أثناء العلاج فى المستشفى وبعد ٣ أشهر من الخروج من المستشفى لدى المرضى الذين يعانون من فشل حاد فى عضلة القلب.

وقد اشتملت هذه دراسة الرصدية الاستباقية على ٩٠ مريضًا تم إدخالهم إلى المستشفى بسبب فشل القلب الحاد حيث تم إجراء الفحص السريرى الكامل وتخطيط صدى القلب ثنائى الأبعاد مع تقييم إجهاد الأذين الأيسر لجميع المرضى، ثم تم تقييم المرضى للحصول على النتائج قصيرة المدى.

كان متوسط عمر مرضانا (٦٠,٣ ± ٩,٥) سنة. بنسبة ٧٠٪ ذكور. فيما يتعلق ببيانات متابعة النتائج على مدى ثلاثة أشهر؛ ١٢,٢٪ من المرضى توفوا، ٥٥,٦٪ احتاجوا للدخول مرة أخرى إلى المستشفى، ٤٦,٧٪ أصيبوا بالرجفان الأذينى، و٤٠٪ أصيبوا بالسكتة الدماغية.

وأظهرت قياسات اجهاد الأذين الأيسر المختلفة ارتباطا كبيرا بحدوث الوفيات، وإعادة الدخول للمستشفى، وحدوث الرجفان الأذينى.

أثبتت دراستنا أن قياسات اجهاد الأذين الأيسر المختلفة (اجهاد المخزون للأذين الأيسر، الاجهاد الانقباضي للأذين الأيسر)، كان لها قيمة إنذارية كبيرة فى التنبؤ بالوفيات والآثار الضارة (مثل الرجفان الأذينى)، فى مرضى فشل القلب الحاد. لذلك، كان لتخطيط صدى القلب ثنائى الأبعاد باستخدام اجهاد الأذين الأيسر أهمية خاصة فى التعامل مع مرضى فشل عضلة القلب الحاد ومتابعتهم.