ORIGINAL ARTICLE

Left Atrial Strain for assessment of left ventricle diastolic dysfunction in acute coronary syndrome patients

Strain atrial gauche pour l'évaluation de la dysfonction diastolique du ventricule gauche chez les patients se présentant pour syndrome coronarien aigu

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Abstract

Introduction: Patients with acute coronary syndrome (ACS) have a high incidence of Left ventricle diastolic dysfunction (DD). Latest algorithms for the assessment of DD lay on 2D parameters and describe a grading to quantify its severity. However, there persists a "gray zone" of values in which DD remains indeterminate.

Aim: to analyze the diagnostic value of Left atrium strain (LAS) for categorization of LV DD and assessment of LV filling pressures in ACS patients.

Methods: Cross-sectional study that prospectively evaluated 105 patients presenting ACS with preserved LV ejection fraction (LVEF). Patients were divided in 4 groups according to the DD grade.

Mean values of LAS, corresponding to three phases of atrial function: reservoir (LASr), conduit (LAScd) and contraction (LASct), were obtained by speckle-tracking echocardiography.

Results: Mean age was 60±10 years, with a gender ratio of 6.14. LASr and LASct were significantly lower according to DD severity (p combined=0.021, p combined=0.034; respectively). E/e' ratio was negatively correlated to LASr (r= - 0.251; p= 0.022) and LASct (r= -0.197; p=0.077). Left atrial volume index (LAVI) was also negatively correlated to LASr (r= -0.294, p= 0.006) and LASct (r= -0.3049, p=0.005). Peak tricuspid regurgitation was negatively correlated to LASr (r=-0.323, p=0.017) and LASct (r=-0.319, p=0.020). Patients presenting elevated LV filling pressures had lower LASr and LASct (p=0.049, p=0.022, respectively) compared to patients witn normal LV filling pressures.

ROC curve analysis showed that a LASr < 22% (Se= 75%, Sp= 73%) and a LASct < 13% (Se= 71%, Sp=58%) can increase the likelihood of DD grade II or III by 4.6 (OR= 4.6; 95% CI: 1.31-16.2; p=0.016) and 3.7 (OR= 3.7; 95% CI: 1.06-13.1; p= 0.047), respectively.

Conclusion: LAS is a valuable tool, which can be used to categorize DD in ACS patients.

Key words: Left atrial function, Left ventricular diastolic function, Speckle-tracking echocardiography, Acute coronary syndrome, Left atrial strain

Résumé

Introduction: Les patients se présentant pour syndrome coronarien aigu (SCA) ont une incidence élevée de dysfonction diastolique (DD) du ventricule gauche (VG). Les derniers algorithmes d'évaluation de la DD reposent sur des paramètres 2D et décrivent une classification pour quantifier sa gravité. Il persiste cependant une « zone grise » de valeurs dans laquelle la DD reste indéterminé.

Objectif: déterminer la valeur diagnostique du strain atrial gauche (SAG) pour la catégorisation de la DD et l'évaluation des pressions de remplissage du VG chez les patients se présentant pour SCA.

Méthodes: Étude transversale ayant évalué prospectivement 105 patients présentant un SCA avec fraction d'éjection du VG préservée. Les patients ont été répartis en 4 groupes selon le grade de la DD. Les valeurs moyennes du LAS, correspondant aux trois phases de la fonction auriculaire : réservoir (SAGr), conduit (SAGcd) et contraction (SAGct), ont été obtenues par speckle-tracking à l'échocardiographie.

Résultats: L'âge moyen était de 60 ± 10 ans, avec un genre ratio de 6,14. LASr et LASct étaient significativement plus bas en fonction de la sévérité de la DD (p combiné = 0.021, p combiné = 0.034 ; respectivement). Le rapport E/e' était négativement corrélé à SAGr (r=- 0,251 ; p=0,022) et SAG ct (r=-0,197 ; p=0,077). Le volume auriculaire gauche indexé était également corrélé négativement au SAGr (r=-0,294, p= 0,006) et au SAGct (r=-0.3049, p=0.005). La vélocité maximale du flux de l'insuffisance tricuspide était négativement corrélée à LASr (r = -0.323, p = 0.017) et à LASct (r = -0.319, p = 0.020). Les patients présentant des pressions de remplissage du VG élevées avaient un LASr et un LASct plus bas (p = 0.049, p = 0.022 ; respectivement) par rapport aux patients présentant des pressions de remplissage du VG normales.

L'analyse de la courbe ROC a montré qu'un SAGr <22 % (Se=75 %, Sp=73 %) et un SAGct<13 % (Se=71 %, Sp=58 %) peuvent augmenter la probabilité d'une DD grade II ou III de 4.6 (OR= 4.6; 95% CI: 1.31-16.2; p=0.016) et 3.7 (OR=3.7; 95% IC: 1.06-13.1; p=0.047) respectivement.

Conclusion: Le SAG est un outil intéressant qui peut être utilisé pour catégoriser la DD chez les patients se présentant pour SCA.

Mots clés: Fonction atriale gauche, fonction diastolique ventriculaire gauche, échocardiographie, syndrome coronarien aigu, strain atrial gauche

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Introduction

Acute coronary syndrome (ACS) can cause remodeling of the left ventricular (LV) structure, leading to an adverse impact on LV relaxation and myocardial stiffness. The resultant decreases LV relaxation and increases LV chamber stiffness then causes LV diastolic dysfunction and increases cardiac filling pressures [1].
LV Diastolic dysfunction occurs prior to LV systolic dysfunction in patients with ACS, and is associated with lower long-term survival rate and worse prognosis [2]. Therefore, it is essential to estimate LV diastolic function earlier and more accurately because it guides the choice of therapeutic strategy and has important prognostic implications [3].
Latest algorithms of The American Society of Echocardiography (ASE) and European Association of Cardiovascular Imaging (EACVI) for the assessment of diastolic dysfunction (DD) lay on several 2D standard parameters and describe a precise grading to quantify its severity [4]. However, there persists a "gray zone" of values in which diastolic function remains indeterminate for patients whose data do not neatly fulfill the algorithms.
The left atrium (LA) plays an active role in modulating LV filling (LVFP) and its evaluation has raised increasing interest for both structural and functional parameters. Assessment of Left Atrial Strain (LAS) using 2-D Speckle tracking is a recently introduced and accurate method for evaluating LA functions. Moreover, studies have implied that LAS, especially LA reservoir strain, is clinically useful for the noninvasive assessment of LV filling pressures in atrial fibrillation and some cardiomyopathies [5,6].
Few studies assessed the role of LA strain in evaluation of LVFP in patients with ACS and preserved LV ejection fraction [7,8].
This study aims to analyze the diagnostic value of left atrial strain for categorization of LV DD and assessment of LVFP in patients with ACS.

Methods

Study population

This was a prospective single center cross-sectional study conducted from October 2021 to March 2022. We consecutively enrolled patients aged >18 years hospitalized with acute coronary syndrome (acute myocardial infarction (AMI) including ST elevation myocardial infarction (STEMI) and non-ST elevation myocardial infarction (NSTEMI) or unstable angina (UA)). Patients with clinical history of atrial fibrillation/futter or the following known structural heart disease, were not included: moderate or severe valvular disease, valve prosthesis, left ventricular ejection fraction < 50%, obstructive hypertrophic cardiomyopathy, acute or chronic constrictive pericarditis, congenital heart disease and intracardiac devices (defibrillator or pacemaker).
Exclusion criteria were as follows: No sinus rhythm, or one of the above-mentioned heart diseases during echocardiographic assessment, hypermobile interatrial septum or interatrial septal aneurysm, poor acoustic windows and ACS with normal coronary angiography.
AMI diagnosis was defined by the presence of clinical symptoms, and/or typical electrocardiographic alterations transient and documented elevation of troponin, according to universal AMI definitions [9].
UA was defined by early-onset angina, progressive or at rest, with or without ischemic alterations at electrocardiogram, and with no elevation of troponin [10].
All patients underwent transthoracic echocardiography within 72 h and had positive coronary angiography findings (diameter decrease of ≥50% in the coronary arteries).
All patients signed a written informed consent about the project, to be able to participate in the study.

Conventional transthoracic echocardiography

A Philips EPIQ 7 was used for ultrasound imaging in our study. Transthoracic echocardiographic evaluation was performed as described in the American and European Society of Echocardiography guidelines and their update [11].
The thicknesses of the interventricular septal and the inferolateral walls as well as LV end-diastolic diameter (LVEDD) were obtained from the parasternal long-axis view. LV mass (LVM) was then calculated. LV end-diastolic volume (LVEDV), end-systolic volume (LVESV), and left ventricular ejection fraction (LVEF) were obtained using the Simpson's biplane method of discs in the apical 4-chamber and 2-chamber views. LA volume is also measured using the biplane disk summation technique and then indexed to body surface area.
LV diastolic function and filing pressures were evaluated according to the ASE and EACVI recommendations published in 2016 [4].
Two waves E and A of mitral inflow velocity were recorded using pulsed wave Doppler from the apical 4 chamber view. The velocity waves (e') of mitral annulus septal and lateral regions were recorded using tissue Doppler. When calculating E/e' ratio, an average value of septal and lateral mitral annulus velocities was used. Pulsed-wave tissue Doppler imaging (TDI) was made using a low wall filter setting, a small sample volume, and an optimal angle between the Doppler beam and the longitudinal motion of the region of interest was minimized as well.
The peak tricuspid regurgitation velocity was assessed with continuous wave doppler (CW) and color flow imaging to obtain highest Doppler velocity aligned.
Patients were divided in 4 groups according to the DD grade: grade I, grade II, grade III and indeterminate grade according to the guidelines. The variables for identifying LV DD and their cutoffs were annular e' velocity: septal e' < 7 cm/s, lateral e' < 10 cm/s, average E/e' ratio > 14, LA volume index (LAVI) > 34 ml/m² and peak tricuspid regurgitation velocity > 2.8 m/s. Patients were secondly divided in 2 groups according to LV filling pressures: normal LV filling pressures (patients with DD grade I) and elevated LV filling pressures (patients with DD grade II and III).

Two-dimensional speckle-tracking echocardiography

Global longitudinal 2D LA strain was analyzed by the speckle tracking technique software. The images were acquired according to the recommendations of ASE [12]. For analysis we used four-chamber and two chamber apical view images of LA. The focus was set to the level of mid-LA to optimize the image quality. Sector depth and width was adjusted to include as little as possible outside the zone of interest. Three consecutive heart cycles were recorded. The endocardial border of LA was traced and a zone of interest was manually adjusted to include the entire LA wall thickness. The entire LA tracking was divided into 6 segments by the software, endocardial borders were readjusted until better tracking was achieved. Then, the software generated a strain average curve. Using R wave onset as starting enabled us to define first positive peak: Peak atrial longitudinal strain (PALS) that represents the reservoir function (LASr), second positive peak, peak atrial contraction strain (PACS) which occurred at maximal LA contraction and represents the contractile function (LASct) (Fig.1). The difference of these peaks represents the conduit function (LAScd). The values were averaged for apical four and two chamber views.

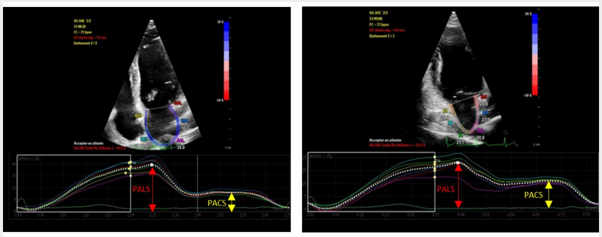

Figure 1. Left atrial strain images from four and two chamber apical view (PALS: Peak atrial longitudinal strain, PACS: peak atrial contraction strain).

Statistical analysis

For statistical analysis SPSS Statistics was used. Mean values were presented ± standard deviation (SD) or 95% confidence intervals (CI). Shapiro-Wilk test was used to check if the distribution of the data was normal. The means were compared using ANOVA and Fisher's Least Significant Difference test was used for post hoc analysis. Categorical variables were demonstrated as absolute numbers and percentages. These data were analyzed using Fisher's exact test or Chi-square test, which ever was deemed appropriate. Continuous variables were demonstrated using mean and standard deviation or median and interquartile intervals. Spearman correlation was used to test for correlation between LAS variables and LV DD variables. Receiver Operating Characteristics (ROC) curves were created to evaluate the performance of LAS components to categorize the DD grade, Cut-offs were determined.
P value of < 0.05 was considered significant.

Results

A total of 105 patients were screened for the study: 53 patients with UA, 44 with NSTEMI and 8 with STEMI (Fig 2).

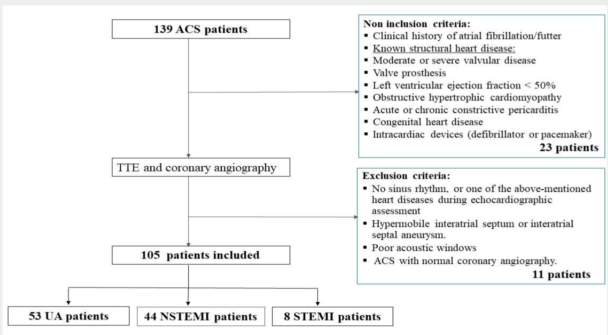

Figure 2. Flow chart of study

ACS: acute coronary syndrome, **NSTEMI**: Non-ST elevation myocardial infarction, **STEMI**: ST elevation myocardial infarction, **TTE**: transthoracic echocardiography, **UA**: unstable angina

Baseline characteristics

The clinical data of patients are presented in table 1.
Mean age of our population was 60±10 years old, with a sex ratio of 6.14. Eighty-four patients had DD grade I, nine patients had DD grade II, two patients had DD grade III and 10 patients had indeterminate grade.
There was a significant difference between DD groups according to history of previous coronary artery bypass graft, peripheral artery disease and chronic renal failure. Levels of troponin and creatinine were higher in the DD grade III.

Echocardiographic characteristics

Transthoracic echocardiographic parameters of the study population are presented in table 2. LASr and LASct were significantly lower in DD grade II and grade III groups.

Table 3 presents correlation between left atrial strain values (LASr and LASct) and most parameters used to define LV diastolic function: E/e' ratio was negatively correlated to LASr (r= - 0.251; p= 0.022) and LASct (r= -0.197; p=0.077). Left atrial volume index was also negatively correlated to LASr (r= -0.294, p= 0.006) and LASct (r= -0.304, p=0.005). In this study, it was possible to evaluate peak tricuspid regurgitation only in 63 patients (56%). Peak TR was negatively correlated to LASr (r=-0.323, p=0.017) and LASct (r=-0.319, p=0.020).

When patients were divided into two groups according to LV filling pressures, normal LV filling pressures (DD grade I) and elevated LV filling pressures (DD grade II and III): the group presenting elevated LV filling pressures had lower LASr and LASct (table 4).

ROC curves were created to evaluate the LAS capacity to categorize the DD grade. The analysis showed that a LASr < 22% (Se= 75%, Sp= 73%) and a LASct < 13% (Se= 71%, Sp=58%) can increase the likelihood of DD grade II or III by 4.6 (OR= 4.6; 95% CI: 1.31-16.2; p=0.016) and 3.7 (OR=3.7; 95% CI: 1.05-13.1; p=0.047), respectively (Fig 3).

Table 1. Baseline clinical characteristics, laboratory assessment and echocardiographic parameters of patients according to diastolic dysfunction groups

Variables	DD grade I (n= 84)	DD grade II (n= 9)	DD grade III (n= 2)	Indeterminate grade (n=10)	P value
Age	59±10	61±12	64	64±7.9	0.750
Male (%)	75 (89)	7 (78)	2 (100)	6 (60)	0.526
Height (Kg)	172±9.3	169±11	178	166±10	0.460
Weight (cm)	83±11	78±19	78±2.8	92±17	0.491
Body mass index (BMI)	27.6 [24-31]	27.3 [23-31]	24 [23-28]	30.7 [27-39]	0.519
Body surface area (BSA)	1.96±0.15	1.91±0.22	1.96±0.02	1.99±0.17	0.644
Vascular risk factor					
Diabetes (%)	46 (55)	5 (56)	2 (100)	7 (70)	0.547
Hypertension (%)	43 (51)	3 (33)	1 (50)	7 (70)	0.539
Smoking (%)	55 (65)	1 (50)	1 (50)	6 (60)	0.747
Medical history					
Previous myocardial infraction (%)	24 (29)	3 (33)	1 (50)	2 (20)	0.765
Previous Percutaneous coronary intervention (%)	26 (31)	3 (33)	1 (50)	10 (100)	0.908
Previous coronary artery bypass graft (%)	2 (2.5)	1 (11)	1 (50)	0	**0.001**
Peripheral artery disease (%)	9 (11)	4 (44)	1 (50)	1 (10)	**0.010**
Chronic renal failure (%)	2 (2.4)	1 (11)	1 (50)	0	**0.004**
Clinical Presentation					
STEMI (%)	8 (10)	0	0	0	0.727
NSTEMI (%)	35 (41)	5 (56)	2 (100)	2 (20)	0.138
Unstable angina (%)	41 (48)	4 (44)	0	8 (80)	0.721
High GRACE score (%)	17 (20)	1 (11)	1 (50)	5 (50)	0.524
Systolic blood pressure (mmHg)	120 [110-140]	125 [120-172]	130 [110-131)	120 [110-140]	0.225
Diastolic blood pressure (mmHg)	70 [60-80]	70 [70-95]	80 [70-82]	80 [67-90]	0.536
Heart rate (bpm)	73±11	73±15	73±15	75±14	0.249
Laboratory assessment					
Hemoglobin (g/dl)	14 [12-15]	11.9 [10.5-13.8]	11 [10-12]	13 [11-14]	0.080
Creatinine (ùmol/l)	70 [59-83]	75 [63-82]	348 [97-350]	64 [60-73]	**<0.001**
Troponin	0	112 [60-2712]	1958 [350-2000]	0	0.942
LDL cholesterol (g/l)	0.91±0.53	0.81±0.24	0.94±0.36	0.86±0.23	0.587
Glycated hemoglobin (%)	6.9 [6-9]	6.5 [6-11]	6.9 [5.9-7]	7.9 [6.3-9.3]	0.722

DD: diastolic dysfunction, **STEMI**: ST elevation myocardial infarction, **NSTEMI**: non-ST elevation myocardial infarction, **UA**: unstable angina

Table 2. Echocardiographic data according to diastolic dysfunction groups

variables	DD grade I (n=84)	DD grade II (n=9)	DD grade III (n=2)	indeterminate Grade (n=10)	P value
LVEF (%)	*61*±7	*57*±9	*56*±8	*58*±9	*0.372*
IVSW (mm)	10.8 [10-11.7]	10.8 [9-12]	15 [11-15]	11.4 [10-13]	**0.004**
ILW (mm)	8.8 [7.7-9.6]	8.7 [6.6-9.3]	12 [9-12]	9 [8-10]	**0.004**
LVEDD (mm)	51±5.1	52±5.6	55±2.9	55±5.9	0.394
LVMi (g/m²)	98 [81-111]	100 [89-115]	176 [118-180]	114 [93-148]	**<0.001**
LV hypertrophy	24 (28)	2 (22)	2 (100)	7 (70)	0.138
RWT	0.30±0.04	0.41	.	.	0.086
E (cm/s)	66.5±16	77.6±20	98.4±23	71.8±21	0.007
A (cm/s)	76.3±20	72±26	43.8±4.4	86.2±23.6	0.097
E/A ratio	0.92±0.28	1.15±0.33	2.2±0.28	0.86±0.22	**<0.001**
Lateral e' (cm/s)	9.8±2.7	9.2±3.9	6.8±0.14	7.8±1.8	0.260
Septal e' (cm/s)	7.7±2.1	7.4±2.3	6.4±0.65	7.2±1.9	0.645
Mean e' (cm/s)	8.8±2.1	8.3±3	6.6±0.39	7.5±1.6	0.336
E/e' mean	7.77±1.9	10.3±3.9	14±2.3	9.7±3.3	**<0.001**
Peak TR (m/s)	2.3±0.29	2.7±0.72	3.3±0.42	.	**<0.001**
LAVi (ml/m²)	33±8.5	44±13	63±24	41±8.1	**<0.001**
Left atrial Strain					
LASr (%)	***26.5***±7.7	***23.8***±5.2	***15.1***±1.7	*30*±10	**0.037**
LASct (%)	**14.6**±5.2	**11.6**±4.2	***6.7***±0.2	*15*±9.5	**0.035**
LAScd (%)	***11.9***±4.3	***12.1***±5.4	***8.3***±1.9	*13*±5.3	*0.521*

DD: diastolic dysfunction, **IVSW**: interventricular septal wall, **ILW**: Inferolateral wall, **LAVi**: Left atrial volume index, **LVEDD**: LV end diastolic diameter, **LVEF**: left ventricular ejection fraction, **RWT**: relative wall thickness, **TR**: tricuspid regurgitation

Table 3. Correlation between the left atrial strain and diastolic dysfunction variables

Variables	LASr		LASct	
	r	p value	r	P value
LAVI (cm²)	-0.294	**0.006**	-0.304	**0.005**
E/A ratio	0.18	**0.005**	0.08	0.38
Lateral E' (cm/s)	0.308	**0.003**	-0.383	**0.004**
Septal E' (cm/s)	0.4	**<0.001**	137	0.205
E/e' ratio	-0.251	**0.022**	-0.197	0.077
Peak TR (m/s)	-0.323	**0.017**	-0.319	**0.020**
PASP (mmHg)	-0.313	**0.020**	-0.383	**0.004**

LASr: left atrial strain of reservoir, **LASct**: left atrial strain of contraction, **LAVi**: Left atrial volume index, **PASP**: pulmonary artery systolic pressure, **TR**: tricuspid regurgitation

Table 4. Left atrial strain according to LV filling pressures

Variables	DD grade I (n=84) Normal LV filling pressures	DD grade II + III (n=11) Elevated LV filling pressures	P value
LASr	26.5±6.7	22.2±5.6	0.049
LASct	14.6±5.2	10.7±4.2	0.022
Conduit function	11.9±4.3	11.4±5.1	0.725

LASr: left atrial strain of reservoir, **LASct**: left atrial strain of contraction

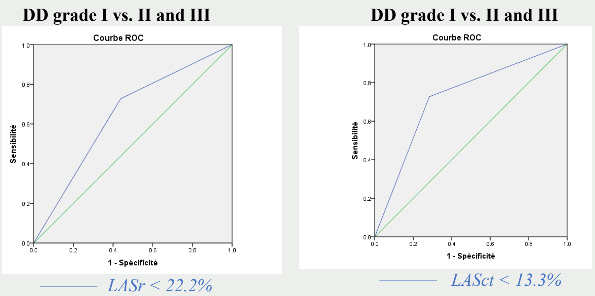

Figure 3. ROC curves to evaluate performance of left atrial strain components to classify diastolic dysfunction (DD grade I vs DD grade II+III). (DD: diastolic dysfunction)

Discussion

The present study investigated the usefulness of LAS for assessment of LVDD in ACS patients.

According to our data, there was an important association between LV DD and LAS. The major and important findings in the present study is that LAS can categorize DD grade. LASr < 22% and a LASct < 13% can increase the likelihood of DD grade II or III by 4.6 (OR= 4.6; 95% CI: 1.31-16.2; p=0.016) and 3.7 (OR= 3.7; 95% CI: 1.06-13.1; p= 0.047), respectively.

LAS assessed by 2D-speckle tracking echocardiography is being extensively studied and its role in risk determination is constantly increasing. It has been evaluated in multiple conditions, such as heart failure, atrial fibrillation and valvular diseases [13].

LA strain determination can be considered a valuable tool in diagnosis of DD in conditions associated with increase filling pressures [14,15]. LASr has been the most studied component of LA function in all clinical scenarios, is emerging as a significant index of LA dysfunction and an early marker of DD when common echocardiographic parameters are still normal. Recently the EACVI proposed a new algorithm for assessment of LV filling pressure (LVFP). LASr is recommended as a parameter for LVFP assessment when one of the three key criteria is missing, and the remaining two are conflicting. With this purpose, LAS could help classify DD in patients falling in the indeterminate range according to standard criteria, who are still close to 20–25% [16]. Indeed, this would be an important applicability of the LAS, identifying those patients with higher degree of DD associated with elevated LVFP.

However, there are few research reports on the role of LA strain when categorizing diastolic function and predicting elevated LVFP in patients with ACS [17,18].

Our results show that LASr was the component presenting the highest capacity to differentiate patients with DD grade II and III from DD grade I. For instance, if we used LASr cut-of found in our study, we would be able to reclassify 65% of patients in the indeterminate group to the grade II or III DD group (with elevated LV end-diastolic pressure).

The same findings were demonstrated by lin et al in the context of chronic coronary syndrome. this study showed that LASr offered additive diagnostic value for the noninvasive estimation of LV filling pressures. LASr and E/e'septal may provide a better single noninvasive index for predicting increased LV filling pressures [19].

Comparing to LASr, LASct presented a lower discriminatory capacity for this purpose. This weak performance of LASct can be due to the compensatory increase of LA contractibility during DD early stages, in such a way that failure of intrinsic atrial contraction would eventually occur only in more advanced DD phases. Besides, it could be due to the fact that we evaluated patients during the acute phase of the coronary disease. In this setting, it is possible that diastolic pressures and E/e' ratio had a sudden increase, but there was not enough time for a decline in atrial contraction, as such decline also depends on atrial myocardial reserve [20].

The possible pathophysiological mechanisms for the explanation of decreasing of LAS with deteriorating diastolic function in ACS patients: the atria are both structurally and functionally related to the ventricles. Structural and functional alterations in the ventricles after myocardial ischemia result in defects in contraction and/or relaxation. This leads to increased atrial pressure and volume, and atrial remodeling results [21].

ACS can also affect atrial function through direct ischemic damage to the atrial myocardium. Poor myocardial perfusion after angioplasty can cause atrial remodeling in patients with acute infarction [22]. In our study, the results of LAS analysis in relation to the severity of coronary artery disease or to the culprit artery are underway. Thus, LA systolic dysfunction in ACS patients leads potentially to complications. Therefore, a detailed assessment of LA systolic function may improve the risk stratification and management of ACS patient.

Furthermore, Li an al conducted a recent retrospective study in order to evaluate the correlation between left atrial function, specifically LA strain, and the GRACE score in ACS patients. Additionally, they sought to determine the utility of LA strain in predicting short-term MACE

post ACS. The trial demonstrated that LASr can identify high-risk patients with ACS as defined by the GRACE score and may be superior to Max LAVI in predicting incidents of MACE in the short-term following ACS [23].
Within the same context, Chu et al demonstrated that PALS provides independent prognostic value for adverse LV remodeling and clinical events after STEMI in any location treated with percutaneous coronary intervention |24].
Given its independency from decline of other heart chambers or structures, we propose LA strain reservoir as an additional noninvasive index to improve DD categorization.
Further research is required to explore how best to incorporate LASr into multiparametric diagnostic models for CAD patients with preserved LVEF and to validate the optimal cutoff value for these parameters to differentiate LVDD from the normal.

Limitations

This study has the limitations that are part of any observational, cross-sectional, single-center study. The small number of patients could also constitute a limitation, especially for the DD grade III group in our sample, because it was the group with the smallest number of subjects. In addition, as in most of the reported studies, we used software developed for the assessment of left ventricular strain and adapted it to the analysis of the atria. This study used only echocardiographic parameters to estimate left ventricular diastolic function, nevertheless we recognize that another study comparing LAS with invasive measurement of left ventricular filling pressures is needed.

Conclusion

The results of the present study showed that left atrial strain was a useful tool to evaluate diastolic function and LV filling pressure, especially when standard criteria are not sensitive enough for its classification. Further studies would be needed to assess whether the incorporation of atrial strain may actually improve the algorithm accuracy and if atrial function implies in an incremental prognostic information in ACS patients.

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