

# Atrial extrasystole and left atrial strain: A brief report

## Abstract

In this short study I summarize my experience with the use of the Left Atrial Strain (LAS) in patients without organic heart disease with palpitations and presence of isolated or repetitive Short Atrial Extrasystole (PACs) including isolated forms of isolated Atrial Fibrillation (AF). For this, I developed a database with 270 patients collected over two years including clinical variables, electrocardiographic with continuous monitoring of three days and conventional echocardiography with the additional contribution of the functional study of the left atrium with two-dimensional LAS of two basal chambers, including the dynamic study with PACs in cases where possible. My most relevant finding was the detection of a case with possible anatomical-functional block in possibly specific intraatrial electromechanical conduction, as well as the potential usefulness of LAS with the incorporation of extrasystole in relation to atrial cardiomyopathy.

**Keywords:** Left Atrial Strain (LAS) • Short Atrial Extrasystoles (PACs) • Isolated Atrial Fibrillation (AF)

## Introduction

Traditionally, atrial extrasystole in the absence of organic heart disease has only acquired some cardiological importance in very symptomatic cases or in situations with high arrhythmic load in ambulatory monitoring systems. Recent reviews give it a greater prognostic value with its possible direct involvement in relation to the appearance of atrial fibrillation, embolic complications and overall mortality [1]. The 2D and 3D echocardiography and, especially the study with LAS, allows us to perform a functional approximation of the atrium before, during and after extrasystole in adequate film sequences. This possibility could provide additional data in the initial view performed from an ambulatory cardiology unit. In a recent article, we tried to make an approximation in the functional study of the left atrium using imaging techniques feasible in any routine echocardiographic study [2]. All the variables used in the article can be reviewed but, in Soler, et al., summary, they emphasize the anatomical and functional study of the left atrium with LAS in its three components (reservoir, conduction and active contraction) as well as the conduction time (tissue Doppler) and the electromechanical dispersion calculated automatically between the septal and lateral basal walls of the atrium using the values of the maximum peak of the atrial reservoir [2]. In the last five years, I personally carry out this study in all my echocardiographic records enjoying an experience of around five thousand patients being, in my opinion, the first prospective clinical work that analyzes the dynamic behavior of the PACs studied with 2D LAS.

## Methodology

The definition of cardiomyopathy includes multiple concepts that stimulate in-depth research in different scenarios. Undoubtedly Goette, et al. summary is one of them represents the study of PACs and their involvement in the diagnostic and therapeutic

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strategy from the perspective of ambulatory cardiology [3]. On the other hand, the analysis of LAS in patients without diagnosed organic heart disease implies a significant independence with respect to left ventricular function. In our study, the control group was formed by patients without repetitive atrial salvos (78 patients) being age, left atrial volume and CHAD2DS2-VASC values obtained multivariable statistical significance in relation to the appearance of atrial fibrillation. Among the clinical variables, the greater anxiety among patients in the control group regarding repetitive forms was significant, which could show more initial disorders in the autonomic nervous system and variations in normal LAS values currently not documented [4]. The results obtained with LAS did not obtain statistical significance in the univariate and multivariate study according to age. Other similar studies, such as MESA [5], seem to indicate the relationship between reduced values of LAS components and their association with PACs.

The existence of left atrial asynchrony has been related to the presence of fibrosis and recurrent atrial fibrillation in multiple studies. However, there is little scientific documentation of the values obtained by segmental LAS among the general population [6]. Regardless of the methodology used, they obtained a cut-off value of 42 ms by 57 ms obtained by us, although without statistical significance correlating age. These findings have been reproduced by more sophisticated imaging techniques such as scanning or cardio resonance as well as electrophysiological mapping, all of which are costly and not applicable in the first line of diagnosis [7].

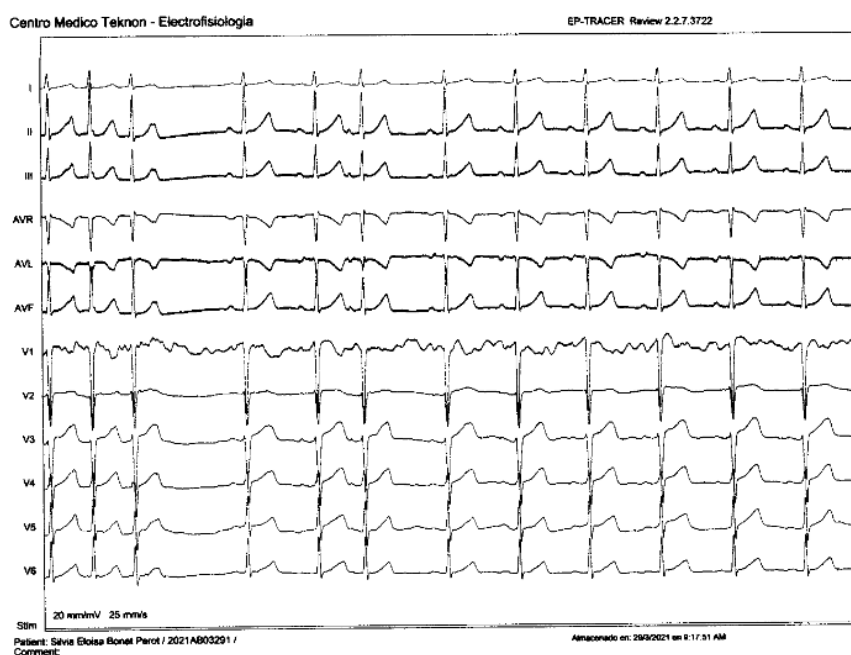
## Results and Discussion

In Figures 1 and 2, we illustrate the graphic study of segmental

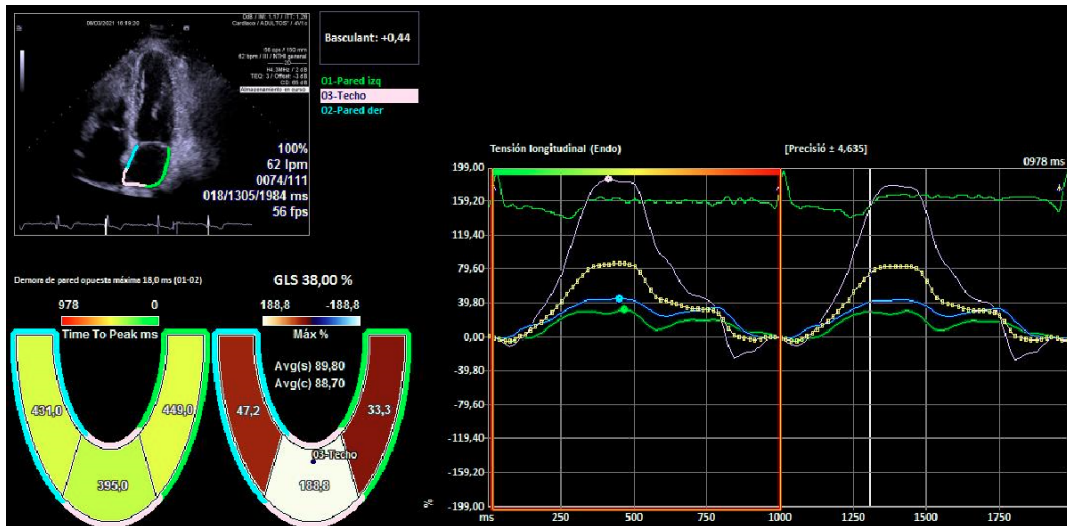
LAS in two patients that we have chosen as most relevant. The first patient, without documented atrial fibrillation and with 3D echocardiography showing a left auricula with normal morphology and volume, showed a possible intraatrial anatomical block. In addition, the segmental curves of the LAS suggest the birth of extrasystole near the pulmonary veins. Unfortunately it could not be adequately mapped in the electrophysiological study due to the rapid fall in atrial fibrillation. Subsequent follow-up of the patient for two years after ablation has shown persistence of high-density atrial extrasystole with moderately symptomatic short repetitive forms without evidence of atrial fibrillation. This patient has not consented to a new electrophysiological study. Analysis with LAS continues to show the same initial activation pattern. In the second case, we observe the disappearance of the active atrial contribution and the homogeneity of the pressures as well as the progressive tendency to recover the initial values of the LAS prior to the PACs. All this is directly linked to the mechanisms of atrial adaptation after PACs and, therefore, provide new objectives in the study of left atrial cardiomyopathy.

### Patient 1

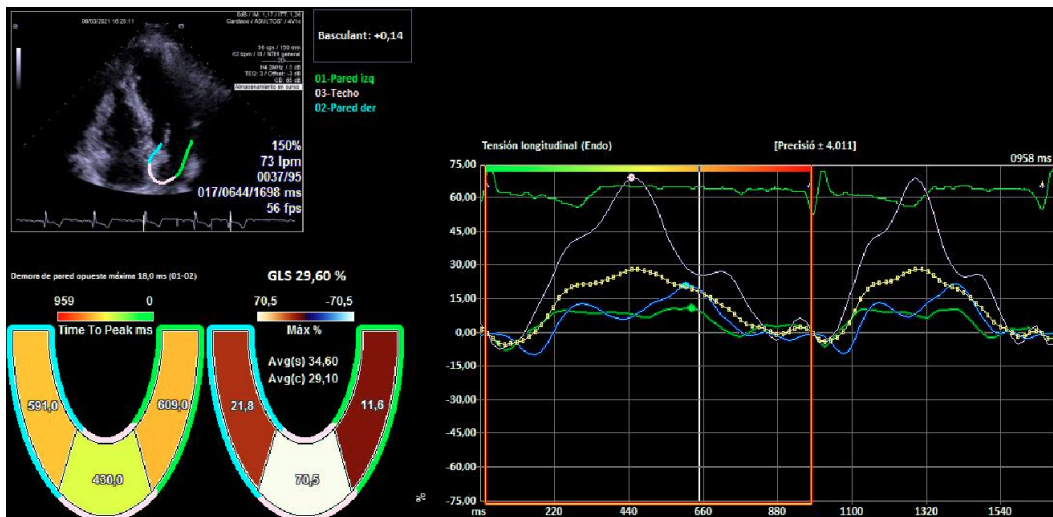
55-Year-old female patient with elevated blood pressure treated with ACEi, family history of ablated atrial fibrillation, and atrial extrasystole of moderate density documented for the last two years with no repetitive forms with clinical limitation to effort without obvious structural heart disease. The basal electrocardiogram showed no alterations to the P wave and the extrasystole was positive on the lower side and V1 with negativity in aVL suggestive of an origin in the posterior left superior pulmonary vein Figure 1A-1D.



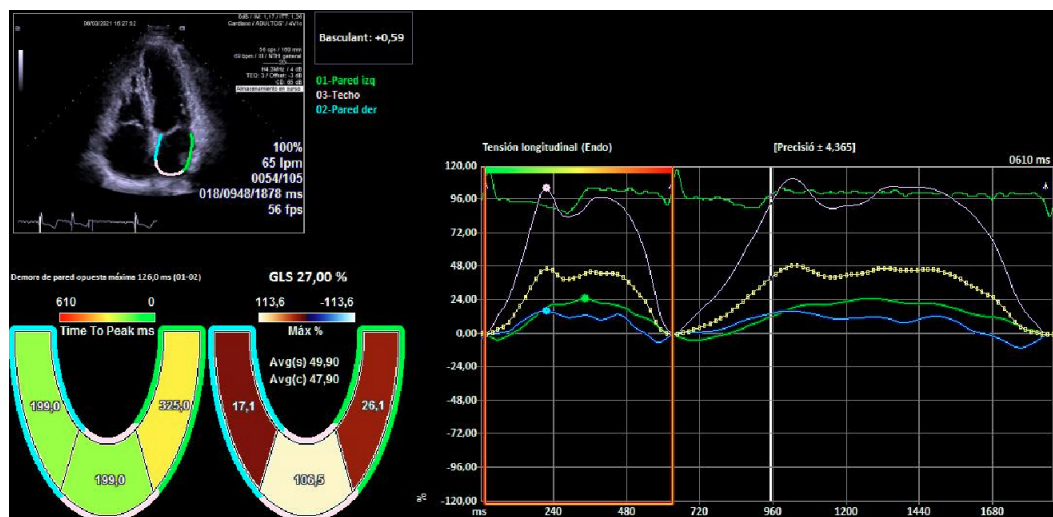
**Figure 1A:** The basal echocardiogram showed no significant alterations or signs of delay in electro-mechanical activation or asynchrony.



**Figure 1B:** Shows the deformation curves of the septal, posterior, and lateral walls during sinus rhythm, showing a maximum peak of positive longitudinal elongation. Very predominant posterior aspect with slight asynchrony with respect to the activation of the septal and lateral walls (18 ms) with reservoir strain values within normal ranges and during extrasystole.



**Figure 1C:** There is a reduction in global and segmental strain values with a reduction in the activation time of the posterior wall and a significant increase in asynchrony with respect to the septal and lateral walls that suggests anisotropic conditions and a type of left intra-atrial block with delay in the activity of the basal segments possibly involving the Bachmann fascicle.



**Figure 1D:** We observe beats after the extrasystole with a tendency to recover the initial global and segmental strain values.

**Patient 2**

75-year-old patient, hypertensive with atrial extrasystole bursts with no evidence of atrial fibrillation with an electrocardiograph P wave of 122 ms and an electrocardiogram which showed slight left

atrial dilation ( $35 \text{ ml/m}^2$ ) with no increase in the electromechanical conduction time with asynchrony in the longitudinal tension between the septal and lateral walls (54 ms, 5% relative to the RR) Figure 2A-2C.

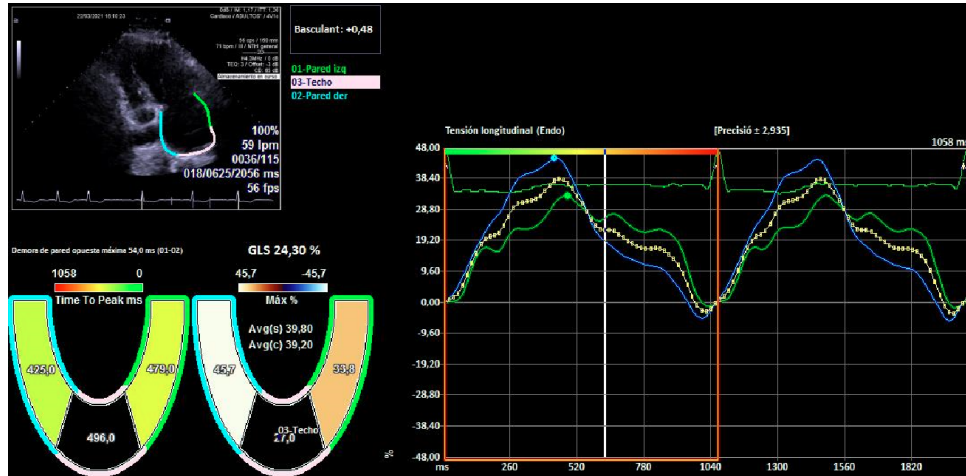


Figure 2A: Shows the basal recording.

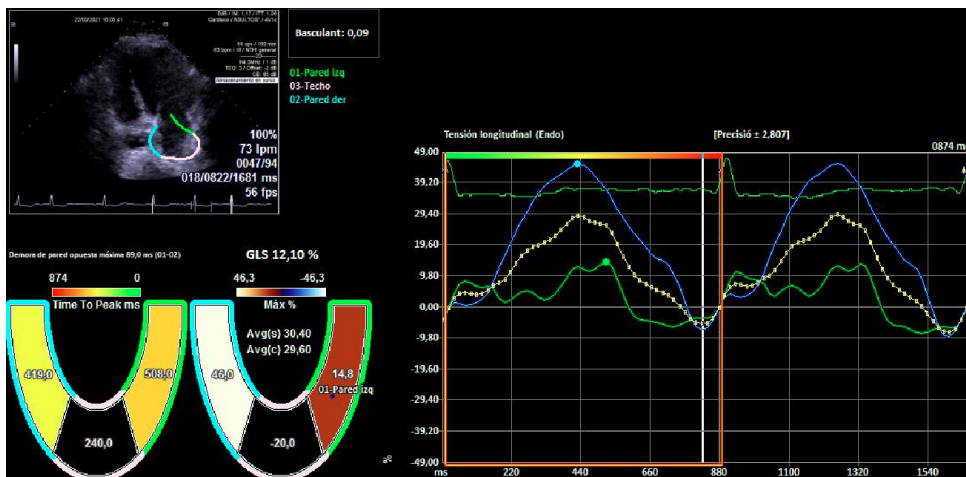


Figure 2B: During the extrasystole with a slight increase in the asynchrony and the global strain initiating a sequence of several recurrent beats.

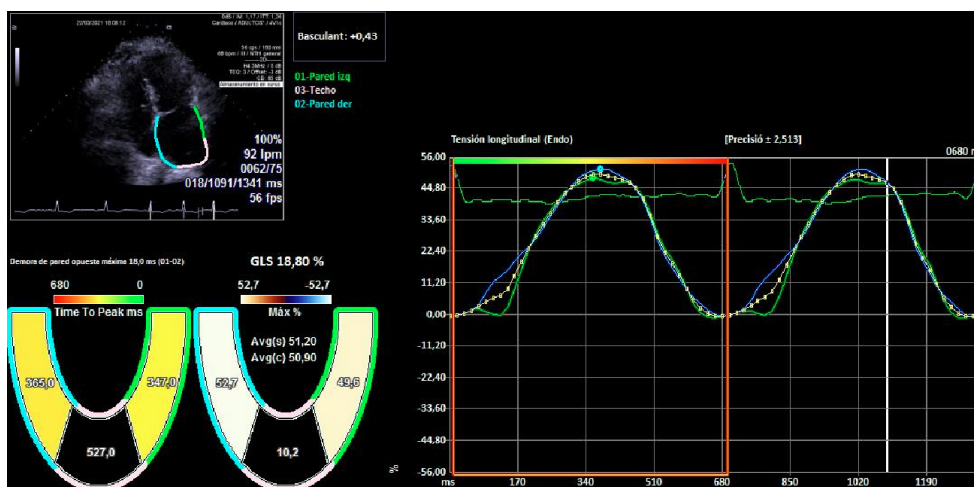


Figure 2C: With an increase in the global and segmental reservoir causing the disappearance of the asynchrony, equalizing the wall tension values without active contraction suggesting a homogeneous activation front due to possible macroreentrant without anatomical obstacle, with increased atrial pressure and adaptive stretching of the atrial wall.

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In an analysis of my experience with the LAS technique in the study of atrial extrasystole, I would highlight the following aspects:

1. The images obtained from the segmental strain curves are temporally reproducible in each patient.
2. There are patients with extremely high global and segmental strain values (up to five times the normal range) that is probably related to autonomic dysfunction and initial degrees of atrial cardiomyopathy. Such sharp deviations should not be overlooked and should be studied further.
3. This study methodology, duly improved with technological advances, should be included in all echocardiography studies in primary cardiology centers.

### Conclusion

The dynamic study of PACs using LAS is a useful measure in the study of left atrial cardiomyopathy. Advances in engineering should contribute to the improvement of the technique and make it applicable in routine studies. The quantification of new parameters in LAS can contribute decisively to a better understanding of left atrial function.

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