



HAL
open science

Left atrial function: the HbA1c for the cardiologist and even more

Erwan Donal, L Elif Sade, Liza Thomas

► To cite this version:

Erwan Donal, L Elif Sade, Liza Thomas. Left atrial function: the HbA1c for the cardiologist and even more. European Journal of Heart Failure, 2022, 10.1002/ejhf.2438 . hal-03554449

HAL Id: hal-03554449

<https://hal.science/hal-03554449>

Submitted on 31 Mar 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

Left atrial function: the HbA1c for the cardiologist and even more

Short title : Need for Left atrial function

Erwan DONAL¹, L. Elif SADE^{2,3}, Liza THOMAS^{4,5,6}

1: University of Rennes, CHU Rennes, Inserm, LTSI – UMR 1099, F-35000 Rennes, France

2: University of Pittsburgh – Heart & Vascular Institute UPMC, Pittsburg PA, USA

3: Baskent University – Cardiology Department, Ankara, Turkey

4: Faculty of Medicine and Health, The University of Sydney, Camperdown, NSW 2006, Australia.

5: Department of Cardiology Westmead Hospital, Westmead, Sydney, NSW 2145, Australia.

6: South Western Sydney Clinical School, University of New South Wales, Liverpool, NSW 2170, Australia.

Conflict of interest:

There are no commercial products involved in this study.

Correspondance

Erwan Donal, MD, PhD,

Service de Cardiologie - Hôpital Pontchaillou – CHU Rennes-

F-35033 RENNES

erwan.donal@chu-rennes.fr

Fax: +33299282510

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process which may lead to differences between this version and the [Version of Record](#). Please cite this article as doi: [10.1002/ejhf.2438](https://doi.org/10.1002/ejhf.2438)

The left atrium (LA) plays an important role in facilitating left ventricular (LV) filling by acting as a reservoir, passive conduit, and active booster pump, as well as a regulator of blood volume. Since the 90's epidemiological data have shown consistently the prognostic importance of LA size even by using simple linear measurements(1). At present, several parameters are readily obtainable by echocardiography for the quantification of LA function. These include, LA volumes, EF, expansion index, LA reservoir strain, and booster strain(2, 3). Should we move forward for a combination of LA volume and function in every single echocardiography report? From a pathophysiological standpoint these 2 are tightly coupled and describe the progression of LA cardiomyopathy(4).

Indeed, increasing number of studies provide evidence in favor of using many of these metrics as an integral part of the echo report. Impairment of LA reservoir strain is the earliest abnormality that can be detected by echocardiography in the spectrum of atrial cardiomyopathy (3, 5-7). It is easy to measure, reproducible and clearly associated with the risk of major clinical end-points like cardio-vascular hospitalization.

The study by Andersen (8) is underscoring LA minimal volume (LAVI min) as a predictor of HF development. LA minimal volume (LAVI min) is a simple parameter to obtain by manual measurement or by automated contouring (also required for the speckle tracking analysis mentioned below) from most patients seen in the echo-labs. Olsen recently published the changes in left atrial size over a decade about Copenhagen City Heart Study with an excellent reproducibility of the measurements(5). Others have demonstrated that LAVI min is correlated with capillary wedge pressure and with the occurrence of dyspnea. The large cohorts like the one of Anderson et al are worth being highlighted (8). It has not always been so clear how an imaging tool could be used as a relevant biomarker for risk prediction in the

general population. In 347 patients with heart failure with preserved ejection fraction, Shin et al. recently reported that LAVI min was more predictive of cardiovascular outcome than indexed maximal LAV (9). LAVI min is supposed to better reflect left ventricular filling pressures. E/e' which is a widely adopted parameter in clinical practice, is considered as a "competitor" to LAVI min. Their respective prognostic value was close.

We would like to thank deeply Authors for the presented results from a large epidemiological data, The Copenhagen City Heart Study, which is a tremendous contribution demonstrating that LA size and function are fundamental parameters in the assessment of clinical outcomes (8). LAVI min has been proposed previously as an important parameter for assessing LV filling pressure and clinical outcomes, yet its use has not been included in the guidelines so far as an indicator for these purposes. The relationship between LAVI min and the prognosis is linear. It is difficult to set a single cut-off value because the cut-off is changing as far as the goal is a moving target including the prediction of atrial fibrillation development, success of ablation, embolic stroke, heart failure development and mortality. From this perspective it could be more appropriate to think about the continuum of LA remodeling process and place LAVI min to its due position in the process (figure 1).

LA strain has been reported as a "biomarker" for predicting the global cardiovascular risk and also for predicting the risk of atrial fibrillation and the risk of thrombo-embolic stroke (3, 10-12). There are very demonstrative studies about the value of LA strain and the risk of developing atrial arrhythmias' (13). Others are not less demonstrative about the value of LA strain in regard to the characterization of diastolic function. Recent EACVI consensus document about heart failure with preserved ejection fraction is advocating the use LA strain(14). Thus, LA strain is not anymore limited to the research ground, it is an integral part

of assessing myocardial mechanics and hemodynamics. LA strain has been reported to correlate better with the capillary wedge pressure than the classical E/e' as mentioned above (15) (figure 1).

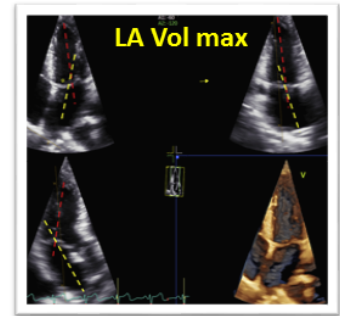
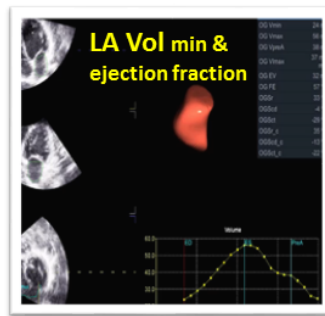
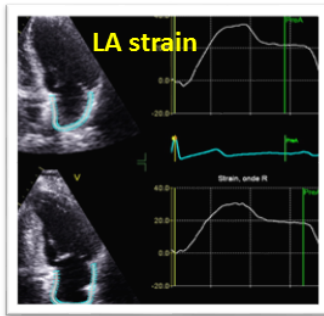
How these evidences fit in our clinical practice? The measurement of LA strain has been the object of the EACVI-ASE consensus paper(10). The measurement is easy to perform but mainly on the most advanced echo-machines. But it could be still a challenge and a matter of time for most practitioners who are busy making a lot of measurements. Could we move forward for a systematic and measurement of LA strain as well as volumes by means of artificial intelligence that is progressively penetrating in our daily clinical practice. Probably yes, because we need to report on the left ventricular ejection fraction and also on left ventricular global longitudinal strain. Softwares that are used for LV and LA are about the same and the speckle tracking technology is becoming mature enough on most echo-machines for automated or semi-automated quantification (16-18). Still the operator should be able to control the computer but most of the work could be undertaken automatically by the machine. So, the future of LA quantification is bright. The value of assessing LA has been demonstrated in large populations consistently as in the study of Andersen et al(8), and we have tools that are becoming robust enough to integrate the data into clinical practice.

1. Vaziri SM, Larson MG, Benjamin EJ, Levy D. Echocardiographic predictors of nonrheumatic atrial fibrillation. The Framingham Heart Study. *Circulation*. 1994;89(2):724-30.
2. Donal E, Galli E, Schnell F. Left Atrial Strain: A Must or a Plus for Routine Clinical Practice? *Circ Cardiovasc Imaging*. 2017;10(10).
3. Thomas L, Muraru D, Popescu BA, Sitges M, Rosca M, Pedrizzetti G, et al. Evaluation of Left Atrial Size and Function: Relevance for Clinical Practice. *J Am Soc Echocardiogr*. 2020;33(8):934-52.
4. Badano LP, Miglioranza MH, Mihaila S, Peluso D, Xhaxho J, Marra MP, et al. Left Atrial Volumes and Function by Three-Dimensional Echocardiography: Reference Values, Accuracy, Reproducibility, and Comparison With Two-Dimensional Echocardiographic Measurements. *Circ Cardiovasc Imaging*. 2016;9(7).

- Accepted Article
5. Olsen FJ, Johansen ND, Skaarup KG, Lassen MCH, Ravnkilde K, Schnohr P, et al. Changes in left atrial structure and function over a decade in the general population. *Eur Heart J Cardiovasc Imaging*. 2021;23(1):124-36.
 6. Raisi-Estabragh Z, McCracken C, Condurache D, Aung N, Vargas JD, Naderi H, et al. Left atrial structure and function are associated with cardiovascular outcomes independent of left ventricular measures: a UK Biobank CMR study. *Eur Heart J Cardiovasc Imaging*. 2021.
 7. Sorensen E, Myrstad M, Solberg MG, Oie E, Tveit A, Aaronaes M. Left atrial function in male veteran endurance athletes with paroxysmal atrial fibrillation. *Eur Heart J Cardiovasc Imaging*. 2021;23(1):137-46.
 8. Andersen DM SM, Olsen FJ, Marott J L, Jensen G B, Schnohr P, Platz E, Schou M, Møgelvang R, Biering-Sørensen T. Measures of Left Atrial Function Predicts Incident Heart Failure in a Low Risk General Population: The Copenhagen City Heart Study. *Eur Jour Heart Fail*. 2022;in press.
 9. Shin SH, Claggett B, Inciardi RM, Santos ABS, Shah SJ, Zile MR, et al. Prognostic Value of Minimal Left Atrial Volume in Heart Failure With Preserved Ejection Fraction. *J Am Heart Assoc*. 2021;10(15):e019545.
 10. Badano LP, Koliass TJ, Muraru D, Abraham TP, Aurigemma G, Edvardsen T, et al. Standardization of left atrial, right ventricular, and right atrial deformation imaging using two-dimensional speckle tracking echocardiography: a consensus document of the EACVI/ASE/Industry Task Force to standardize deformation imaging. *Eur Heart J Cardiovasc Imaging*. 2018;19(6):591-600.
 11. Thomas L, Marwick TH, Popescu BA, Donal E, Badano LP. Left Atrial Structure and Function, and Left Ventricular Diastolic Dysfunction: JACC State-of-the-Art Review. *J Am Coll Cardiol*. 2019;73(15):1961-77.
 12. Sade LE, Keskin S, Can U, Colak A, Yuce D, Ciftci O, et al. Left atrial mechanics for secondary prevention from embolic stroke of undetermined source. *Eur Heart J Cardiovasc Imaging*. 2020.
 13. Sarvari SI, Haugaa KH, Stokke TM, Ansari HZ, Leren IS, Hegbom F, et al. Strain echocardiographic assessment of left atrial function predicts recurrence of atrial fibrillation. *Eur Heart J Cardiovasc Imaging*. 2016;17(6):660-7.
 14. Smiseth OA, Morris DA, Cardim N, Cikes M, Delgado V, Donal E, et al. Multimodality imaging in patients with heart failure and preserved ejection fraction: an expert consensus document of the European Association of Cardiovascular Imaging. *Eur Heart J Cardiovasc Imaging*. 2021.
 15. Lundberg A, Johnson J, Hage C, Back M, Merkely B, Venkateshvaran A, et al. Left atrial strain improves estimation of filling pressures in heart failure: a simultaneous echocardiographic and invasive haemodynamic study. *Clin Res Cardiol*. 2019;108(6):703-15.
 16. Cho JS, Shrestha S, Kagiya N, Hu L, Ghaffar YA, Casaclang-Verzosa G, et al. A Network-Based "Phenomix" Approach for Discovering Patient Subtypes From High-Throughput Cardiac Imaging Data. *JACC Cardiovasc Imaging*. 2020;13(8):1655-70.
 17. Florescu DR, Badano LP, Tomaselli M, Torlasco C, Tarteia GC, Balseanu TA, et al. Automated left atrial volume measurement by two-dimensional speckle-tracking echocardiography: feasibility, accuracy, and reproducibility. *Eur Heart J Cardiovasc Imaging*. 2021;23(1):85-94.
 18. Salte IM, Ostvik A, Smistad E, Melichova D, Nguyen TM, Karlsen S, et al. Artificial Intelligence for Automatic Measurement of Left Ventricular Strain in Echocardiography. *JACC Cardiovasc Imaging*. 2021;14(10):1918-28.

Figure 1: our vision of the value of left atrial function assessment

Atrial Cardiomyopathy (increasing severity)



Embolic stroke
Subclinical afib

Overt afib

HFpEF

Permanent afib
HFrEF

Mortality

