

Defining Speckle Tracking Echocardiography (STE); used to Diagnose Systolic Subclinical Dysfunction

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We read with great interest the article, “Systolic Subclinical Dysfunction in Anabolic Steroid Users: A Real-Life Study,” published in April 2025. The author used myocardial work analysis and speckle tracking echocardiography (STE) to assess and detect early systolic dysfunction in bodybuilders using anabolic steroids. While the term myocardial work analysis was defined, the author did not provide a definition for STE. According to the author, “Myocardial work analysis is a recent technique that incorporates left ventricular (LV) afterload data into global longitudinal strain (GLS) analysis. In addition to correlating with myocardial oxygen consumption, myocardial work enables the analysis of LV efficiency, proving to be a highly effective technique for ventricular performance analysis.” We commend the author for clarifying the decision to forgo conventional echocardiography, acknowledging that normal echocardiographic parameters do not rule out the presence of subclinical ventricular dysfunction on two-dimensional echocardiography.

We would like to provide a definition of STE to enhance conceptual clarity for readers.

STE is a quantitative echocardiographic technique that analyzes myocardial function by speckle pattern.^{1,2} It is a self-automated, software-based, angle-independent method used to detect cardiac abnormalities at early stages.^{3,4} Initially developed only for LV assessment, STE has since been adapted for use in all cardiac chambers thanks to advancements in medical sciences.⁴ Various cardiac pathologies, such as valve diseases and hypertensive cardiomyopathy, tend to progress over time and may ultimately result in complications that can lead to chamber dysfunction.⁵ STE is used for the early detection of myocardial abnormalities,

as it can accurately detect both acute and chronic myocardium structural changes.⁵ This technique is of great importance because it offers superior prognostic capabilities compared to conventional methods previously used.⁵ It assesses cardiac function throughout the cardiac cycle.⁴ It operates by differentiating the speckle patterns,³ which are generated as random, grainy patterns on the echocardiographic images when ultrasound waves directed at the heart are reflected from myocardial tissue.² These patterns are generated by the constructive and destructive interference of ultrasound waves reflected from myocardial tissue.² The speckle pattern is associated with myocardial movements, and changes in the pattern show myocardial deformation.⁵ The speckle pattern is integrated into functional units called kernels, each of which can be differentiated from the other by using STE.³ The degree of deformation of the analyzed myocardial segment relative to its initial dimensions can be defined as strain.³ STE is a technique used to calculate both strain and strain rate.³ In addition, STE aids in assessing the occurrence, direction, and velocity of left ventricle rotation.¹ It allows the elaboration of myocardial deformation, and the kernel movement is detected in three spatial directions: longitudinal, radial, and circumferential.^{1,3} Longitudinal strain refers to cardiac deformation from the base to the apex of the heart.³ GLS is measured using apical 4-, 3-, and 2-chamber views.⁴ Global circumferential strain (GCS) and global radial strain (GRS) are measured using parasternal short-axis views.⁴ STE is integrated for the identification of early and subtle myocardial damage and is now widely implemented in clinical practice.⁴ The author’s application of this technique is commendable.

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References

1. Mondillo S, Galderisi M, Mele D, Cameli M, Lomoriello VS, Zacà V, et al. Speckle-Tracking Echocardiography: A New Technique for Assessing Myocardial Function. *J Ultrasound Med*. 2011;30(1):71-83. doi: 10.7863/jum.2011.30.1.71.
2. Geyer H, Caracciolo G, Abe H, Wilansky S, Carerj S, Gentile F, et al. Assessment of Myocardial Mechanics Using Speckle Tracking Echocardiography: Fundamentals and Clinical Applications. *J Am Soc Echocardiogr*. 2010;23(4):351-69. doi: 10.1016/j.echo.2010.02.015.
3. Martini L, Lisi M, Pastore MC, Righini FM, Rubboli A, Henein MY, et al. The Role of Speckle Tracking Echocardiography in the Evaluation of Advanced-Heart-Failure Patients. *J Clin Med*. 2024;13(14):4037. doi: 10.3390/jcm13144037.
4. Pastore MC, De Carli G, Mandoli GE, D’Ascenzi F, Focardi M, Contorni F, et al. The Prognostic Role of Speckle Tracking Echocardiography in Clinical Practice: Evidence and Reference Values from the Literature. *Heart Fail Rev*. 2021;26(6):1371-81. doi: 10.1007/s10741-020-09945-9.
5. Lisi M, Cameli M, Mandoli GE, Pastore MC, Righini FM, D’Ascenzi F, et al. Detection of Myocardial Fibrosis by Speckle-Tracking Echocardiography: From Prediction to Clinical Applications. *Heart Fail Rev*. 2022;27(5):1857-67. doi: 10.1007/s10741-022-10214-0.

Reply

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To the Editor,

We appreciate the opportunity to respond to the recent letter commenting on our article “Systolic Subclinical Dysfunction in Anabolic Steroid Users: A Real-Life Study.” We thank the author for reinforcing the importance of speckle tracking echocardiography (STE) and for elucidating its foundational principles.

As described in our Methods, global longitudinal strain and myocardial work (MW) parameters were obtained via vendor-specific STE software (EchoPAC, GE Healthcare). These techniques are validated and widely accepted for early detection of systolic dysfunction, especially in patients with preserved ejection fraction.^{1,2} MW adds incremental value by incorporating afterload dependence into strain measurements, aligning with physiological reproducibility and correlating with myocardial oxygen consumption.^{2,3}

While STE fundamentals are extensively documented in consensus guidelines⁴ and reference textbooks such as *Aplicações do Strain Cardíaco*,⁵ our manuscript prioritized clinical application and new insights from MW analysis in

anabolic-androgenic steroid (AAS) users, a population for whom early myocardial injury often remains unnoticed by conventional echocardiography.

Our study contributes by:

Applying STE-based MW analysis in male AAS users, revealing subclinical systolic dysfunction, despite normal left ventricular ejection fraction;

Demonstrating limitations of conventional echocardiographic metrics in detecting early myocardial impairment;

Emphasizing the utility of advanced echocardiographic tools in sports cardiology and preventive cardiovascular assessment.

Therefore, while acknowledging the author’s intent to clarify STE definitions, we respectfully emphasize that our manuscript was not written as a technical primer, but rather as a clinical study focusing on deformation imaging implementation in a real-world high-risk cohort.

We would like to thank the Editor and IJCS Editorial Board for enabling this scholarly exchange and for advancing the ongoing discourse on quantitative echocardiography in cardiovascular risk stratification.

References

1. Lang RM, Bierig M, Devereux RB, Flachskampf FA, Foster E, Pellikka PA, et al. Recommendations for Chamber Quantification: A Report from the American Society of Echocardiography’s Guidelines and Standards Committee and the Chamber Quantification Writing Group, Developed in Conjunction with the European Association of Echocardiography, a Branch of the European Society of Cardiology. *J Am Soc Echocardiogr*. 2005;18(12):1440-63. doi: 10.1016/j.echo.2005.10.005.
2. Russell K, Eriksen M, Aaberge L, Wilhelmsen N, Skulstad H, Remme EW, et al. A Novel Clinical Method for Quantification of Regional Left Ventricular Pressure-Strain Loop Area: A Non-Invasive Index of Myocardial Work. *Eur Heart J*. 2012;33(6):724-33. doi: 10.1093/eurheartj/ehs016.
3. Lustosa RP, Rabischofsky A, Gripp EA. My Approach to Myocardial Work: Why and for Whom? *Arq Bras Cardiol: Imagem Cardiovasc*. 2023;36(3):e20230052. doi: 10.36660/abcimg.20230052i.
4. Lang RM, Badano LP, Mor-Avi V, Afzal J, Armstrong A, Ernande L, et al. Recommendations for Cardiac Chamber Quantification by Echocardiography in Adults: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. *Eur Heart J Cardiovasc Imaging*. 2015;16(3):233-70. doi: 10.1093/ehjci/jev014.
5. Del Castillo J, Silveira O Neto. *Aplicações do Strain cardíaco*. Rio de Janeiro: Revinter; 2024.



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