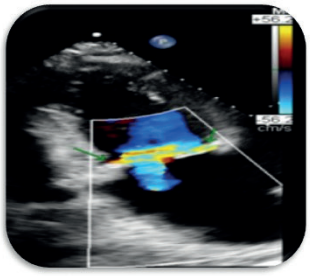
Review Article

My Approach to Assessing Mitral Regurgitation with Splay: What Does It Mean for Severity?

Gustavo Nishida,[1] *Natasha Soares Simões dos Santos,*[1] *Jorge Eduardo Assef,*[1] *Andrea de Andrade Vilela*[1]
Instituto Dante Pazzanese de Cardiologia,[1] *São Paulo, SP – Brazil*

Central Illustration: My Approach to Assessing Mitral Regurgitation with Splay: What Does It Mean for Severity?



- Side-lobe artifact
- Red flag for significant MR
- Not all cases of splay indicate significant MR; not all cases of significant MR show splay
- Reassessment/complementary imaging: caution regarding underestimation when grading MR severity
- Potential diagnostic and prognostic value

Arq Bras Cardiol: Imagem cardiovasc. 2026;39(2):e20260024

MR: mitral regurgitation.

Abstract

Echocardiographic assessment of mitral regurgitation (MR) is multiparametric and often challenging. The artifact known as splay has been described as an additional tool for estimating the severity of regurgitation. The term refers to a side-lobe artifact that forms a horizontal arc on color Doppler imaging. This same phenomenon can also be observed in other valvular heart diseases, such as aortic regurgitation. In 2020, Wiener et al. reported that splay was present in 81% of cases of significant MR, reaching 93% in eccentric jets, whereas the prevalence was only 16% in mild MR. Verbeke et al. associated the artifact with larger regurgitant volumes. A splay width greater than 29 mm was identified as an independent predictor of adverse cardiovascular outcomes. Although its presence alone does not denote severe MR, splay acts as a red flag, suggesting that regurgitation may be greater than it appears and indicating the need for careful reassessment of the transthoracic echocardiogram or, possibly, complementary transesophageal echocardiography. Further evidence and systematic evaluations are needed to investigate the best strategy for incorporating these data into the multiparametric approach to MR.

Keywords

Severity of Illness Index; Mitral Valve Insufficiency; Echocardiography

Mailing Address: Gustavo Nishida •
Instituto Dante Pazzanese de Cardiologia. Avenida Dr Dante Pazzanese, 500. Postal code: 04012-909. São Paulo, SP – Brazil
E-mail: gustavonishida@yahoo.com.br
Manuscript received March 12, 2026, revised manuscript March 23, 2026, accepted March 25, 2026
Editor responsible for the review: Marcelo Tavares

DOI: https://doi.org/10.36660/abcimg.20260024i

The challenge of grading mitral regurgitation severity

Echocardiographic assessment of mitral regurgitation (MR) is multiparametric and often challenging. Especially in the presence of multiple, eccentric, non-homogeneous

jets throughout the cardiac cycle or non-circular regurgitant orifices, it is paramount to combine qualitative and quantitative data that can guide the grading of valvular regurgitation.[1,2] In this context, an artifact has been described as an additional finding in the assessment of MR.

Splay: a valuable artifact

The term splay refers to a side-lobe artifact that appears as a horizontal arc on color Doppler imaging, dispersing signal and usually observed along the atrial surface of the valve, extending beyond anatomical boundaries[3] (Figure 1).

Ultrasound transducers emit energy not only in the main direction (central axis of the beam), but also in lateral directions, forming secondary lobes of lower intensity. When these side lobes encounter highly reflective structures, such as cardiac walls or valves, they may generate echoes that are incorrectly mapped by the imaging system, as if they originated from the main axis, resulting in artifacts on echocardiographic images.[4]

Considering the mechanism that gives rise to this artifact, splay can be documented in other valvular regurgitations, for example, aortic regurgitation (Figure 2).

Evidence of diagnostic and prognostic value

In 2020, Wiener et al.[3] described this artifact as a clue for detecting significant MR. In an analysis of 200 cases of MR documented by transthoracic echocardiography, half with significant regurgitation and half with mild regurgitation, the prevalence of splay was 81% and 16%, respectively. In eccentric jets, the prevalence reached 93% of cases. This sign was observed in proto-, meso-, tele-, and holosystolic jets; on the atrial and ventricular surface of the mitral annulus; in preserved and reduced left ventricular ejection fraction; in different etiologies (prolapse, rheumatic disease, mitral annulus calcification, functional); and using different commercially available echocardiogram brands. It has most frequently been documented in apical views, but it has also been observed in parasternal long- and short-axis views. The origin of the signal appears to be related to blood flow rate per unit area. With higher gain, lower ultrasound frequency, and lower Nyquist limit, higher prevalence and greater extent of splay are observed. In their study, harmonic imaging had little effect on splay.

In a single-center registry by Verbeke et al.[5] in Ghent, Belgium, a 27% prevalence of color Doppler splay was reported in 469 patients, correlating with greater effective regurgitant orifice area, regurgitant volume, and vena contracta width. They used a Vivid E9 echocardiographic system, GE Healthcare, equipped with an M5Sc-D transducer for all examinations. For color Doppler assessment, the following standardized parameters were applied for all patients: transmission frequency of 2.2 MHz, velocity scale of 3.5 kHz (aliasing velocity of 63 cm/s), and gain adjusted to −5 dB. Splay was more prevalent and showed greater width in patients with significant MR. In their cohort, splay

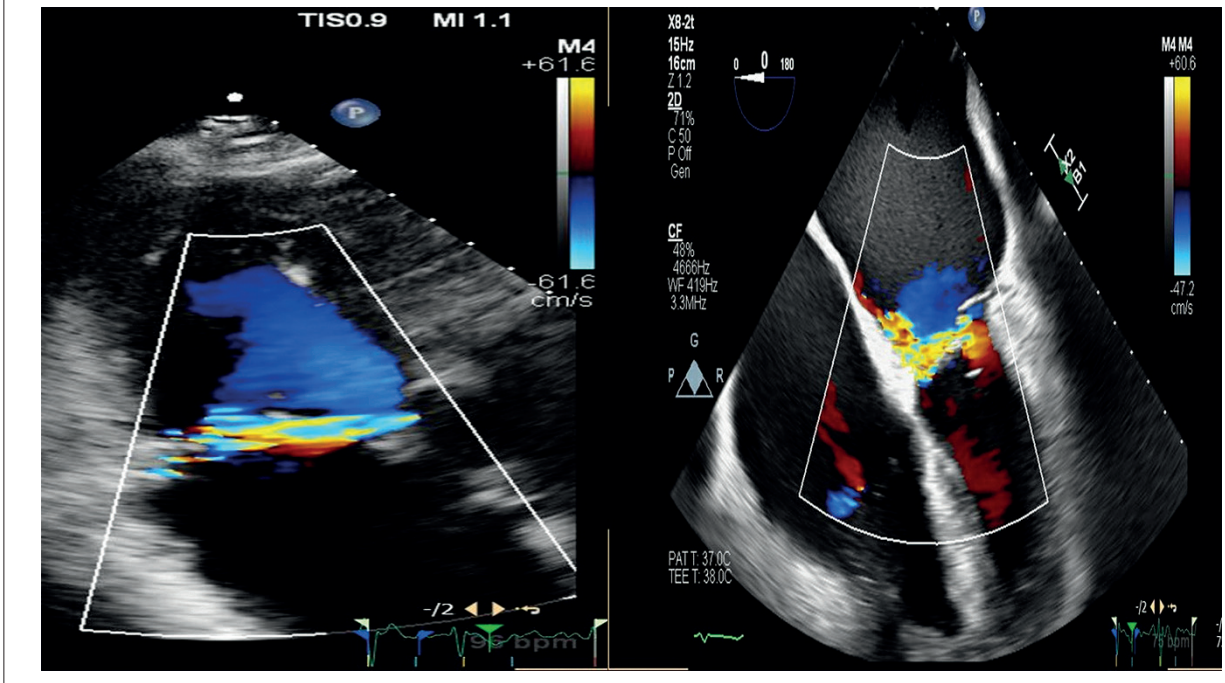


Figure 1 – *Splay in MR. On the left, transthoracic echocardiography in the apical 3-chamber view shows evidence of splay on color Doppler at the level of the mitral annulus. On the right, transesophageal echocardiography reveals significant MR with a medially directed eccentric jet.*

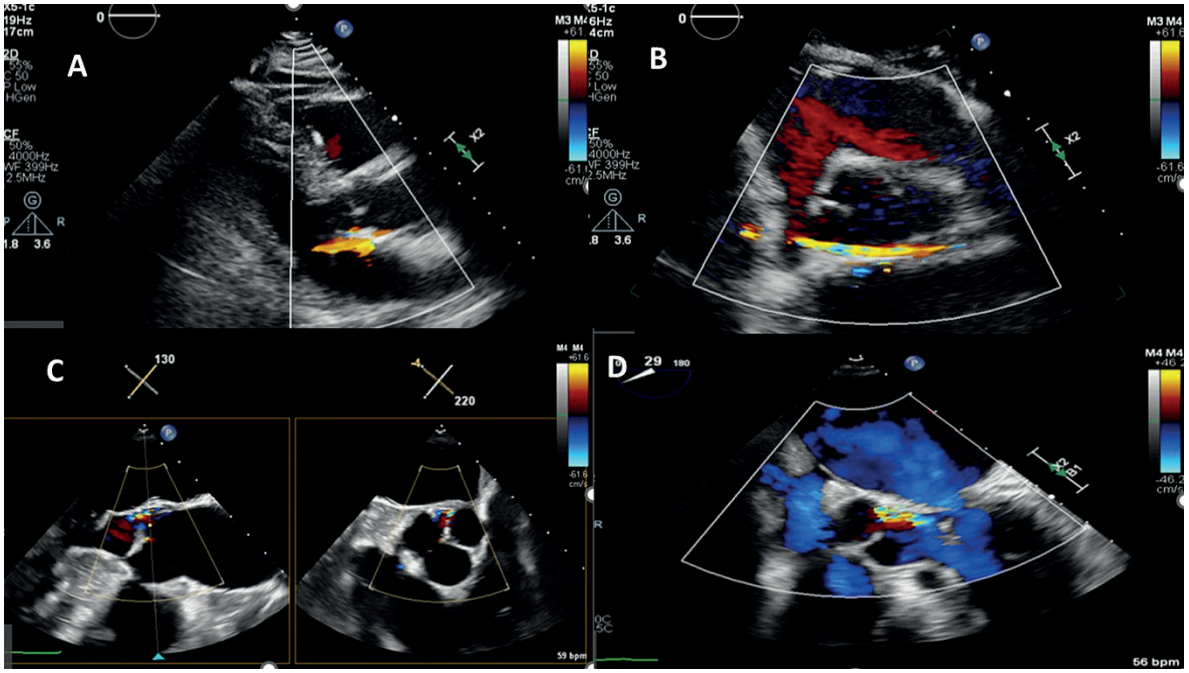


Figure 2 – *Splay in aortic regurgitation. In the upper images, transthoracic echocardiography in the parasternal long-axis (A) and short-axis (B) views shows evidence of splay, extending beyond anatomical boundaries. In the lower images (C and D), transesophageal echocardiogram reveals an eccentric aortic regurgitant jet originating from the commissural region.*

width greater than 29 mm was an independent predictor of cardiovascular outcomes, with additional prognostic value.

Final considerations

This is a relatively recent description of an echocardiographic sign that requires further evidence and studies to guide its systematic integration into echocardiographic practice. Although it does not necessarily indicate significant MR and is not indispensable for defining this severity, splay represents a potential tool signaling the possibility that regurgitation is more severe than appears. This red flag prompts careful reassessment of the transthoracic echocardiogram and, when appropriate, complementary transesophageal echocardiography when other findings lead us to suspect significant MR (Central Illustration).

In the words of Bertrand et al.,[6] splay is "the artifact that tells the truth," by signaling the possibility of significant MR.

Author Contributions

Conception and design of the research and writing of the manuscript: Nishida G; acquisition of data and analysis and interpretation of the data: Nishida G, Santos NSS; critical revision of the manuscript for intellectual content: Nishida G, Santos NSS, Assef JE, Vilela AA.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This study is not associated with any thesis or dissertation work.

Ethics approval and consent to participate

This article does not contain any studies with human participants or animals performed by any of the authors.

Use of Artificial Intelligence

The authors did not use any artificial intelligence tools in the development of this work.

Availability of Research Data

The underlying content of the research text is contained within the manuscript.

References

1. Zoghbi WA, Adams D, Bonow RO, Enriquez-Sarano M, Foster E, Grayburn PA, et al. Recommendations for Noninvasive Evaluation of Native Valvular Regurgitation: A Report from the American Society of Echocardiography Developed in Collaboration with the Society for Cardiovascular Magnetic Resonance. J Am Soc Echocardiogr. 2017;30(4):303-71. doi: 10.1016/j.echo.2017.01.007.
2. Grayburn PA, Thomas JD. Basic Principles of the Echocardiographic Evaluation of Mitral Regurgitation. JACC Cardiovasc Imaging. 2021;14(4):843-53. doi: 10.1016/j.jcmg.2020.06.049.
3. Wiener PC, Friend EJ, Bhargav R, Radhakrishnan K, Kadem L, Pressman GS. Color Doppler Splay: A Clue to the Presence of Significant Mitral Regurgitation. J Am Soc Echocardiogr. 2020;33(10):1212-9.e1. doi: 10.1016/j.echo.2020.05.002.
4. Bertrand PB, Levine RA, Isselbacher EM, Vandervoort PM. Fact or Artifact in Two-Dimensional Echocardiography: Avoiding Misdiagnosis and Missed Diagnosis. J Am Soc Echocardiogr. 2016;29(5):381-91. doi: 10.1016/j.echo.2016.01.009.
5. Verbeke J, Kamoen V, Calle S, De Buyzere M, Timmermans F. Color Doppler Splay in Mitral Regurgitation: Hemodynamic Correlates and Outcomes in a Clinical Cohort. J Am Soc Echocardiogr. 2022;35(9):933-9. doi: 10.1016/j.echo.2022.04.006.
6. Bertrand PB, Nagata Y, Namasivayam M, Levine RA. The Artifact that Tells the Truth: Color Doppler Splay Unmasking Significant Mitral Regurgitation. J Am Soc Echocardiogr. 2020;33(10):1220-2. doi: 10.1016/j.echo.2020.08.003.