

VALVULAR HEART DISEASE

CLINICAL CASE

New Mitral Regurgitation Unveiling Infective Endocarditis in an Adolescent With Mitral Valve Prolapse



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ABSTRACT

BACKGROUND Infective endocarditis (IE) is a potentially life-threatening condition, possibly occurring in overlap with preexisting structural cardiac abnormalities. The Duke Criteria represent a cornerstone in the diagnosis of IE, and the detection of new regurgitation represents a major criterion that may be overlooked.

CASE SUMMARY We present a case of a 14-year-old girl with mitral valve prolapse (MVP) who developed IE. Despite initial negative echocardiographic findings for vegetations, thorough analysis revealed the presence of a new regurgitation jet at P3 scallop, thereby distinguishing it from the mild preexisting central mitral regurgitation.

DISCUSSION This case highlights the diagnostic challenges of IE when vegetations are absent on echocardiography. In this setting, recognizing a new jet from a preexisting regurgitation is crucial in making the diagnosis.

TAKE-HOME MESSAGES Echocardiography represents the cornerstone for diagnosing IE. Indeed, in patients with MVP, careful assessment of new regurgitation, even in the absence of visible vegetations, should raise suspicion for IE. (JACC Case Rep. 2025;30:104015) © 2025 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

HISTORY OF PRESENTATION

A 14-year-old female patient with a known history of mitral valve prolapse (MVP) and atopic dermatitis in treatment with topical corticosteroids presented to the emergency department with reports of nausea, vomiting, and intermittent fever in the previous weeks. On admission, the examination revealed sinus tachycardia, normal blood pressure, and a normal respiratory rate, whereas laboratory tests showed an

increased blood count and a mildly raised C-reactive protein (CRP) value.

PAST MEDICAL HISTORY

Her last transthoracic echocardiography (TTE) 4 months before admission showed a known MVP in Barlow disease conditioning mild mitral regurgitation (MR) (**Figure 1**, **Video 1**). The patient was also affected by atopic dermatitis, which was treated with

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Manuscript received March 25, 2025; accepted April 2, 2025.

**ABBREVIATIONS
AND ACRONYMS****¹⁸F-FDG** = fluorine-18
fluorodeoxyglucose**CRP** = C-reactive protein**IE** = infective endocarditis**MR** = mitral regurgitation**MVP** = mitral valve prolapse**PET/CT** = positron emission
tomography/computed
tomography**SE** = stress echocardiography**TEE** = transesophageal
echocardiography**TTE** = transthoracic
echocardiography

corticosteroid treatment, and 3 months before admission, she underwent a surgical excision of a benign lesion without reported complications. At that time, no antibiotic prophylaxis was performed.

DIFFERENTIAL DIAGNOSIS

On the basis of the patient's history and clinical presentation, several differential diagnoses were considered. Infective endocarditis (IE) was a primary concern given the known MVP, intermittent fever, and elevated inflammatory markers. However, viral or bacterial gastroenteritis could explain the nausea, vomiting, and systemic symptoms. Additionally, systemic inflammatory conditions, such as Kawasaki disease or rheumatic fever, were also evaluated, particularly in a pediatric patient with fever and an elevated inflammatory response.

Further investigations were performed, including serial blood cultures, which resulted in a positive

INVESTIGATIONS

result for methicillin-sensitive *Staphylococcus aureus*. The initial TTE showed no clear vegetations; however, a new regurgitation jet was found, located at and originating from a different region of the valve when compared with previous serial evaluation in the context of the MVP. Thus, transesophageal echocardiography (TEE) imaging was performed and confirmed the known MVP with worsened MR compared with preadmission findings, with a P3 prolapse causing moderate to severe MR (Figures 2A to 2D, Videos 2 and 3).

TAKE-HOME MESSAGES

- Careful echocardiographic assessment and correct thinking is the key. Differentiating new from preexisting regurgitation, especially in patients with a preexisting valvular heart disease, requires a detailed evaluation and confirmation with TEE, which should be repeated at short-term follow-up to identify early evolution of the disease.
- Multidisciplinary and multimodality collaboration enhances diagnosis. Integrating clinical findings, microbiology, and imaging—including PET/CT when necessary—can solidify the diagnosis and guide management.
- Tailored diagnostic and therapeutic approach is needed. Given the variability in imaging sensitivity and specificity, a tailored, multidisciplinary diagnostic strategy is critical, and a thoughtful, individualized strategy ensures to avoid misdiagnosis and to guide appropriate treatment.

In agreement with the microbiologist, considering the high probability of IE and the increased degree of MR despite the absence of vegetations at echocardiographic findings, magnetic resonance imaging of the brain was performed and revealed multiple lesions of possible embolic origin. Additionally, a fluorine-18 fluorodeoxyglucose (¹⁸F-FDG) positron emission tomography (PET)/computed tomography (CT) scan was scheduled, which showed focal tracer uptake corresponding to the mitral valve region and spleen hypermetabolism (Figure 3).

The case was discussed by an endocarditis multidisciplinary team, and IE was considered highly probable. Therefore, according to the modified Duke Criteria, long-term antibiotic treatment was chosen. After serial negative results of blood cultures, the patient was discharged with oral antibiotic treatment, which was continued until the first echocardiographic follow-up.

MANAGEMENT

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VISUAL SUMMARY Timeline of the Case	
Timeline	Events
Day 1	A 14-year-old girl with known mitral valve prolapse presented to the emergency department for intermittent fever and symptoms of nausea and vomiting. Baseline evaluation showed sinus tachycardia, a normal respiratory rate, hyperthermia, and increased inflammatory indexes at blood test. Serial blood cultures were performed.
Day 2	TTE showed no clear vegetations, but significant MR was found, with jet originating from a different location compared with previous echocardiographic analysis.
Day 4	Serial blood culture results were positive for MSSA. IV antibiotic targeted therapy was initiated.
Day 5	TEE showed hemodynamically significant MR secondary to significant prolapse of the P3 segment, which was not present at TTE performed 4 months before admission. MRI of the brain was also performed, showing multiple lesions of possible embolic origin.
Day 7	¹⁸ F-FDG PET/CT was scheduled, showing focal tracer uptake corresponding to the mitral valve region and spleen hypermetabolism.
Day 30	After almost 4 weeks of IV antibiotic therapy, repeated negative blood culture results and indexes of inflammation, along with stable imaging analysis, the patient was discharged with an indication to continue oral antibiotic therapy until the first echocardiographic follow-up.
Day 60	At first follow-up, TTE and TEE follow-up showed further worsening of MR, with an advanced flail of the P3 scallop, likely a sequela of previous endocarditis. Results of serial blood cultures and repeat CRP tests were negative. Oral antibiotic treatment was stopped.
Day 75	SE was performed and showed good functional performance and hemodynamic stability, a normal increase in PASP, and no arrhythmias during stress performance. Conservative strategy, with very close echocardiographic follow-up, was initially chosen, considering the patient's age, the absence of extravalvular involvement (normal LV and LA dimension, preserved RV size and function) and preserved hemodynamic stability and functional status at SE.

¹⁸F-FDG PET/CT = fluorine-18 fluorodeoxyglucose positron emission tomography/computed tomography; CRP = C-reactive protein; IV = intravenous; LA = left atrial; LV = left ventricular; MR = mitral regurgitation; MSSA = methicillin-sensitive *Staphylococcus aureus*; PASP = pulmonary artery systolic pressure; SE = stress echocardiography; TEE = transesophageal echocardiography; TTE = transthoracic echocardiography.

OUTCOME AND FOLLOW-UP

The patient was re-evaluated in an ambulatory care setting at 1-month follow-up. The TTE and TEE follow-up showed further worsening MR, with an advanced flail of the P3 scallop, likely a sequela of previous endocarditis (Figures 4A to 4D, Videos 4 and 5). However, results of serial blood cultures and CRP testing were negative at 1 month, with no evidence of active vegetations at echocardiographic evaluation.

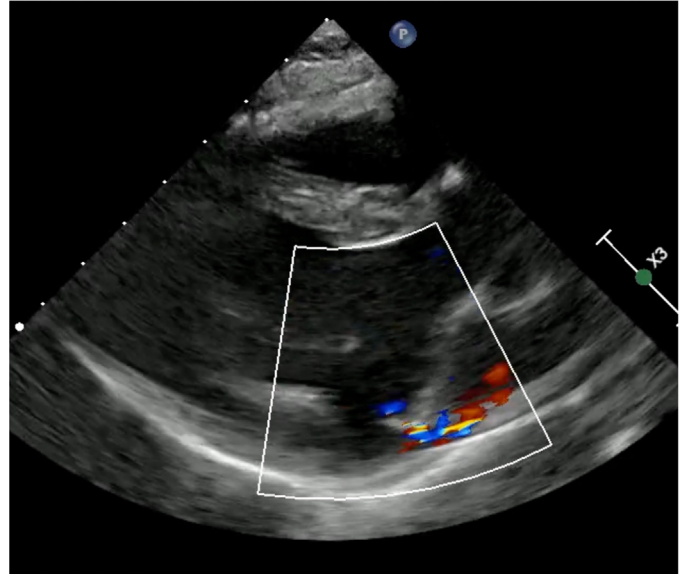
The patient under follow-up also underwent stress echocardiography (SE) as part of her comprehensive assessment. This imaging showed a normal hemodynamic response without arrhythmias and a preserved functional capacity without signs of hemodynamic maladaptation, with a normal increase of pulmonary pressure at the peak of stress. Thus, after multidisciplinary re-evaluation, surgical intervention was temporarily deferred because of the absence of vegetations, the lack of extravalvular involvement, and the response to SE, all further supporting the decision to continue medical management while maintaining close clinical surveillance.

DISCUSSION

Echocardiography, particularly TEE, represents a cornerstone in the diagnostic evaluation of IE both in native valve endocarditis and prosthetic valve endocarditis.¹ However, subtle changes in valvular regurgitation can be difficult to detect, particularly when distinguishing newly developed lesions from preexisting conditions. Significant new valvular regurgitation on echocardiography as compared with previous imaging represents a major criterion of the revised Duke Criteria.¹ However, differentiating it from chronic MR, especially in patients with underlying valvular heart disease (ie, MVP), poses significant challenges.²

A cursory TTE examination could have mistaken the newly developed eccentric MR jet for the patient's preexisting central MR. However, meticulous assessment, including TEE, provided crucial diagnostic clarity. The absence of flow convergence at the previously documented MR location suggested an alternative origin of regurgitation, which was confirmed at the P3 segment through TEE, also at 1-month follow-up, where flail with complete eversion of the leaflet was visible. Although PET/CT imaging can provide valuable adjunctive evidence, particularly in cases of prosthetic valve endocarditis, its specificity in native valve infections remains limited.³ False-positive findings may arise in response to inflammatory or

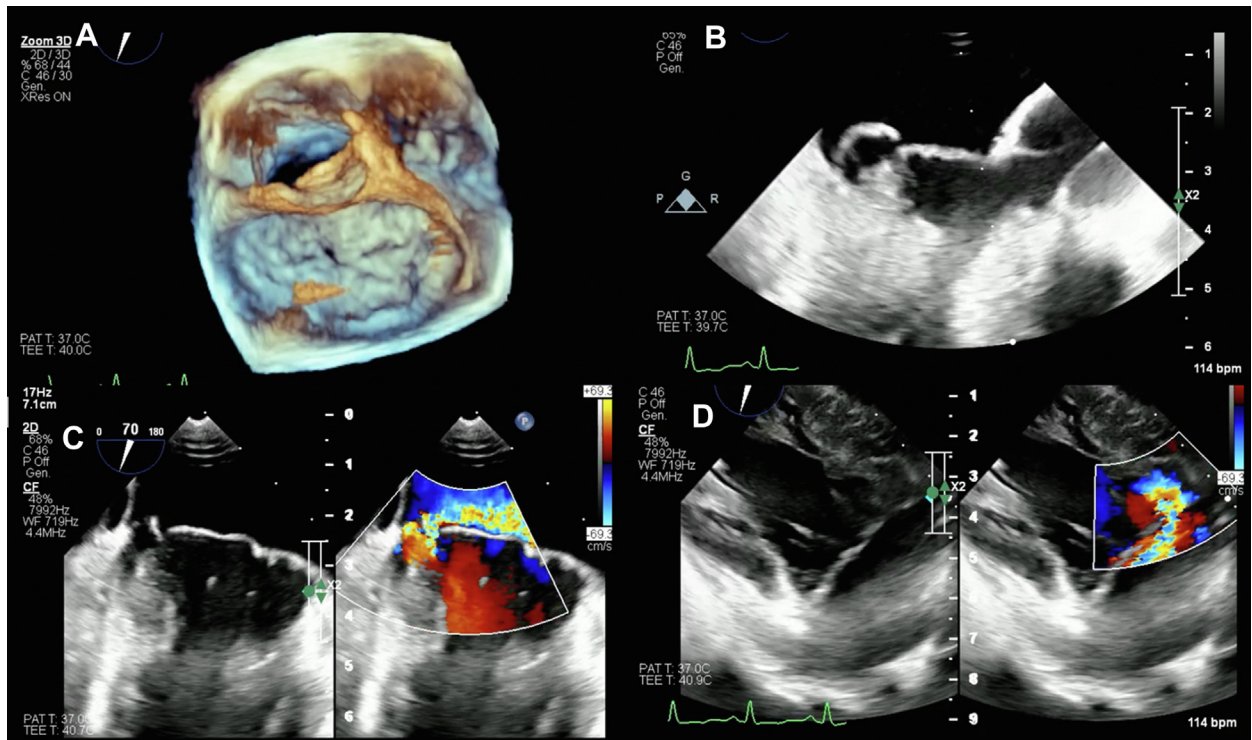
FIGURE 1 Transthoracic Echocardiographic Parasternal Long-Axis View 4 Months Before Admission Showing Mitral Valve Prolapse Conditioning Mild Mitral Regurgitation



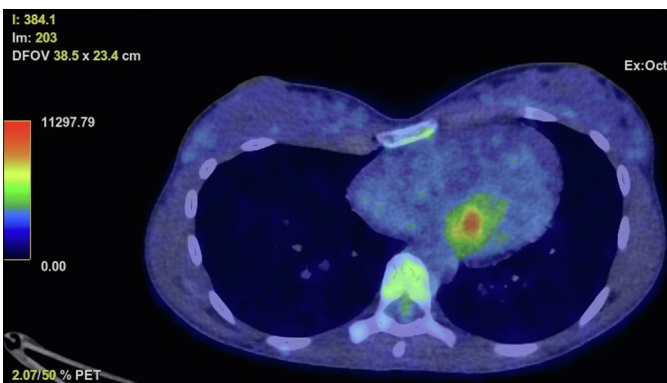
degenerative processes unrelated to active infection, thereby potentially leading to diagnostic uncertainty.⁴

In this patient, the diagnosis was primarily established through detailed echocardiographic assessment, which revealed a new eccentric MR jet at the P3 segment, a key distinguishing factor from the patient's preexisting central MR. Given that the Duke criteria consider new valvular regurgitation a major diagnostic factor for IE, meticulous echocardiographic evaluation played a crucial role in confirming the diagnosis. Complementary imaging techniques, such as ¹⁸F-FDG PET/CT, were useful, providing critical additional information, but not indispensable in reaching definitive diagnostic and therapeutic decisions.

Indeed, this case serves as an important reminder that IE diagnosis is not solely dependent on the presence of vegetations. Although vegetations remain a hallmark of endocarditis, their absence does not exclude the disease, and new regurgitation may be the only detectable sign of valvular involvement. In fact, masses may be absent, particularly in cases where embolism represents the initial sign presentation or when multiple embolic events have already occurred. Another crucial aspect is the importance of serial evaluations in cases of high clinical suspicion, even in the absence of detectable masses. In fact, this

FIGURE 2 Transesophageal Echocardiography

(A) A 3-dimensional transesophageal echocardiography (TEE) en face view of the mitral valve showing the bileaflet prolapse with the culprits represented by the prolapse of scallop P3. (B) Midesophageal long-axis view showing the prolapse/flail of scallop P3. (C) Midesophageal commissural and (D) long-axis transgastric views showing the P3 prolapse conditioning hemodynamically significant mitral regurgitation.

FIGURE 3 Fluorodeoxyglucose Positron Emission Tomography Transverse Plane Image Showing Focal Tracer Uptake Corresponding to the Mitral Valve Region

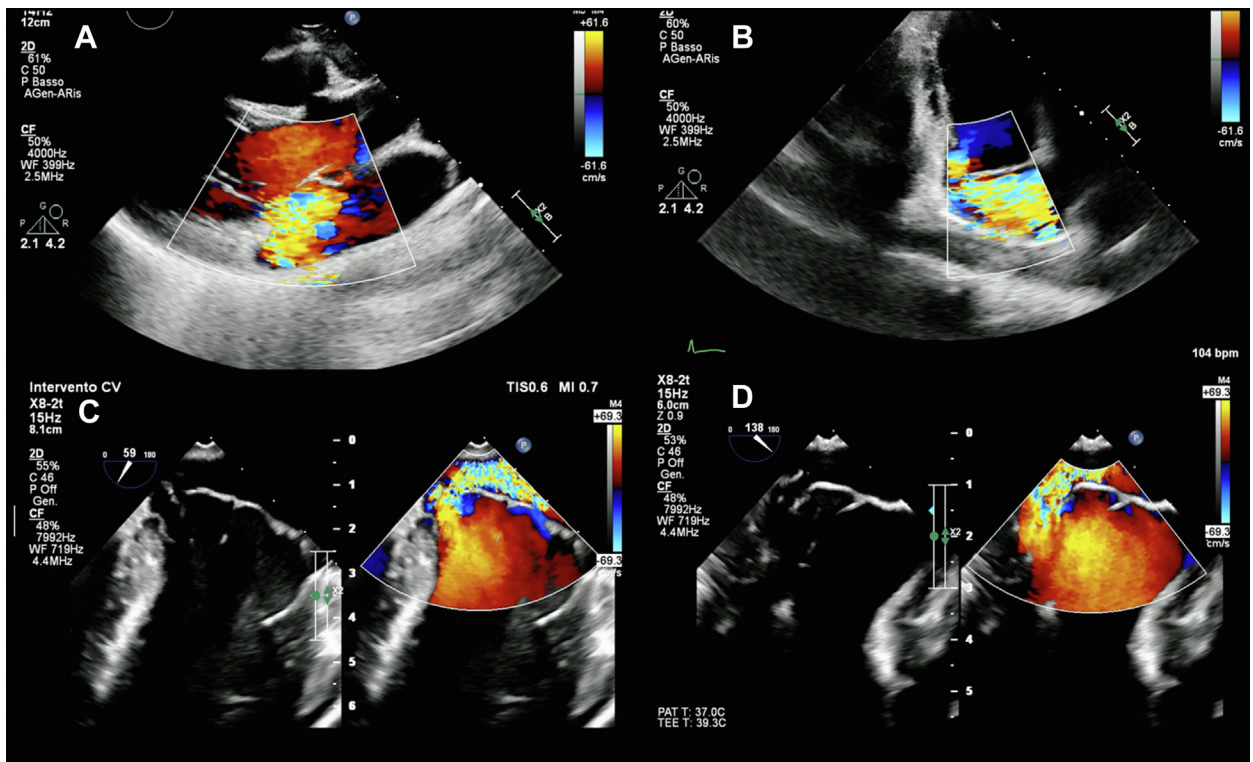
PET = positron emission tomography.

case highlights how postendocarditic lesions can be progressive, and the complete flail was detected only at 1-month follow-up.

Despite confirmation of IE, a conservative management strategy was chosen because of several critical factors, including the patient's young age (14 years), preserved hemodynamic stability and pulmonary pressure during SE,⁵ and the absence of extravalvular involvement (normal left ventricular and atrial size, preserved right ventricular function and pulmonary pressure).

Recent studies emphasized that surgery in IE should be reserved for patients with severe heart failure, uncontrolled infection, large vegetations at risk of embolization, or significant structural damage to the valve or surrounding tissues.⁶ This case highlights the importance of individualized decision making in IE, by balancing the benefits of early surgical intervention against the potential risks,

FIGURE 4 Transthoracic and Transesophageal Echocardiography at 1-Month Follow-Up



(A and B) Color Doppler parasternal long-axis and 2-chamber views showing severe mitral regurgitation at 1-month follow-up. (C) Midesophageal commissural view showing the culprit P3 flail determining hemodynamically significant mitral regurgitation. (D) Midesophageal long-axis view showing the P3 flail with complete eversion of the leaflet, likely a sequela of previous endocarditis. Abbreviations as in Figure 2.

particularly in young patients responding well to medical therapy. Close clinical surveillance remains essential to detect any progression of disease that may warrant reconsideration of surgical management.

CONCLUSIONS

This case underscores the critical role of meticulous echocardiographic assessment in diagnosing IE, even in the absence of visible vegetations. The recognition of new regurgitation in our patient with the new eccentric MR jet at P3, distinct from pre-existing MR, was key to diagnosis, thus highlighting the importance of detailed image interpretation. Given the patient's young age, favorable response to antibiotics, and stable SE, a temporary conservative approach was justified. This case

reinforces that in IE, precise thinking, not just advanced imaging, is the key to accurate diagnosis and optimal management. Additionally, an individualized targeted treatment strategy should always be preferred, to avoid misdiagnosis and guide correct treatment.

FUNDING SUPPORT AND AUTHOR DISCLOSURES


The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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REFERENCES

1. Fowler VG, Durack DT, Selton-Suty C, et al. The 2023 Duke-International Society for Cardiovascular Infectious Diseases criteria for infective endocarditis: updating the modified Duke Criteria. *Clin Infect Dis*. 2023;77(4):518–526. <https://doi.org/10.1093/cid/ciad271>
2. Zegri-Reiriz I, de Alarcón A, Muñoz P, et al. Infective endocarditis in patients with bicuspid aortic valve or mitral valve prolapse. *J Am Coll Cardiol*. 2018;71(24):2731–2740. <https://doi.org/10.1016/j.jacc.2018.03.534>
3. Delgado V, Ajmone Marsan N, De Waha S, et al. 2023 ESC guidelines for the management of endocarditis. *Eur Heart J*. 2023;44(39):3948–4042. <https://doi.org/10.1093/EURHEARTJ/EHAD193>
4. ten Hove D, Slart RHJA, Sinha B, Glaudemans AWJM, Budde RPJ. 18F-FDG PET/CT in infective endocarditis: indications and approaches for standardization. *Curr Cardiol Rep*. 2021;23(9):130. <https://doi.org/10.1007/S11886-021-01542-Y>
5. Khoo B, Buratto E, Fricke TA, et al. Outcomes of surgery for infective endocarditis in children: a 30-year experience. *J Thorac Cardiovasc Surg*. 2019;158(5):1399–1409. <https://doi.org/10.1016/J.JTCVS.2019.06.024>
6. Cahill TJ, Prendergast BD. Infective endocarditis. *Lancet*. 2016;387(10021):882–893. [https://doi.org/10.1016/S0140-6736\(15\)00067-7](https://doi.org/10.1016/S0140-6736(15)00067-7)

KEY WORDS cardiovascular disease, echocardiography, endocarditis, imaging, mitral valve

 **APPENDIX** For supplemental videos, please see the online version of this paper.