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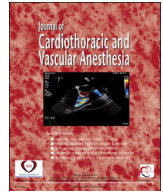
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## Diagnostic Dilemma

# A Case of Divergent Mitral Regurgitation Jets



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**Key Words:** mitral valve regurgitation; mitral valve; crossed sword sign; TEE; transesophageal echocardiogram; flail leaflet; prolapse; valvular heart disease; color Doppler; echocardiography

A 79-YEAR-OLD MAN experiencing shortness of breath was scheduled for transcatheter aortic valve replacement. He had a history of previous coronary artery bypass graft and congestive heart failure due to severe aortic valve stenosis (aortic valve area < 1.0 cm<sup>2</sup>). The mitral valve was interrogated as part of the intraoperative transesophageal echocardiography examination with and without color-flow Doppler. The midesophageal views of the mitral valve with color-flow Doppler demonstrated a peculiar mitral regurgitation pattern with simultaneous anteriorly and posteriorly directed mitral regurgitation jets (Figs 1 and 2, Video 1A and 1B). What is the diagnosis?

### Diagnosis: Crossed Swords Sign

Eccentric mitral regurgitation jets represent a unileaflet disease with jet direction toward a restricted leaflet and away from a prolapsing/flail leaflet. Complex bileaflet prolapse can result in mitral regurgitation jets emanating in various

directions. This has been referred to as the crossed swords sign (Figs 1 and 2, Video 1A and 1B).

Studies have shown this sign to be present in about 27% of cases for mitral valve surgery, with male preponderance.<sup>1,2</sup> Diverging jets imply 2 regurgitant orifice areas and a consequent larger regurgitant volume. Presence of the crossed swords sign suggests a requirement for complex surgical procedures and possible replacement.

In this patient, there was a flail P3 segment (Figs 3 and 4, Videos 2A and 2B) with slightly restricted P1 segment of the mitral valve (Fig 4, Video 2A and 2B) resulting in divergent mitral regurgitation jets from different locations in the coaptation zone. The combined mitral regurgitation severity of both the jets was judged to be severe. Considering the high-risk nature of the procedure in this patient, the lesion was ignored, and the transcatheter aortic valve replacement procedure was completed uneventfully. Postoperatively, the patient became asymptomatic despite no improvement in mitral regurgitation.

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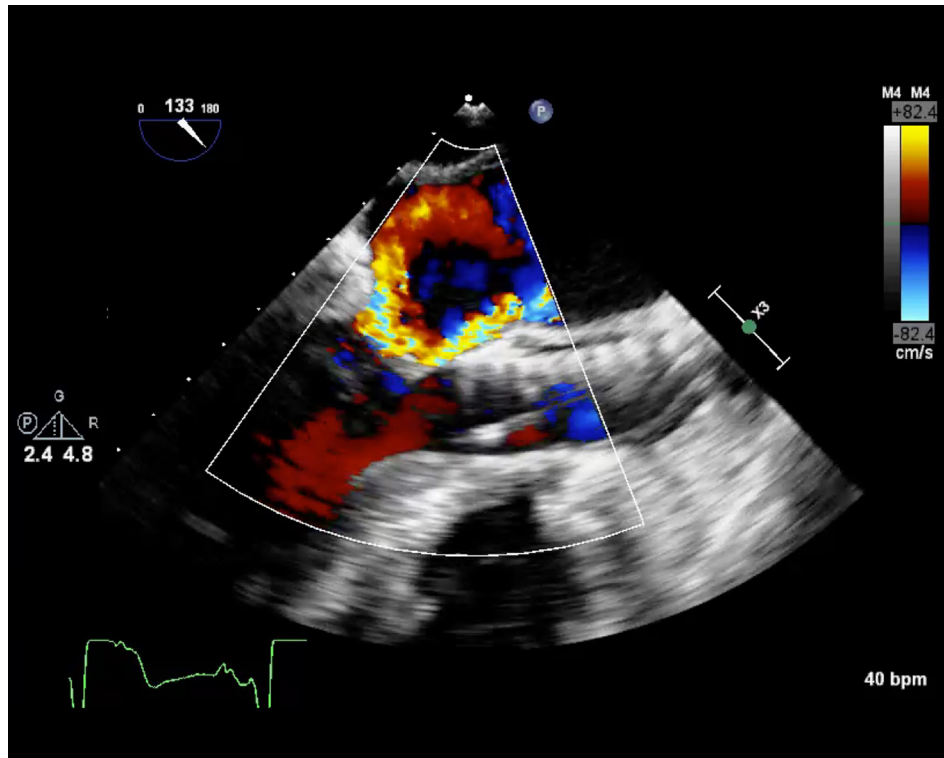


Fig 1. Midesophageal long-axis view of the mitral valve with color-flow Doppler demonstrating simultaneous anteriorly and posteriorly directed mitral regurgitation jets.

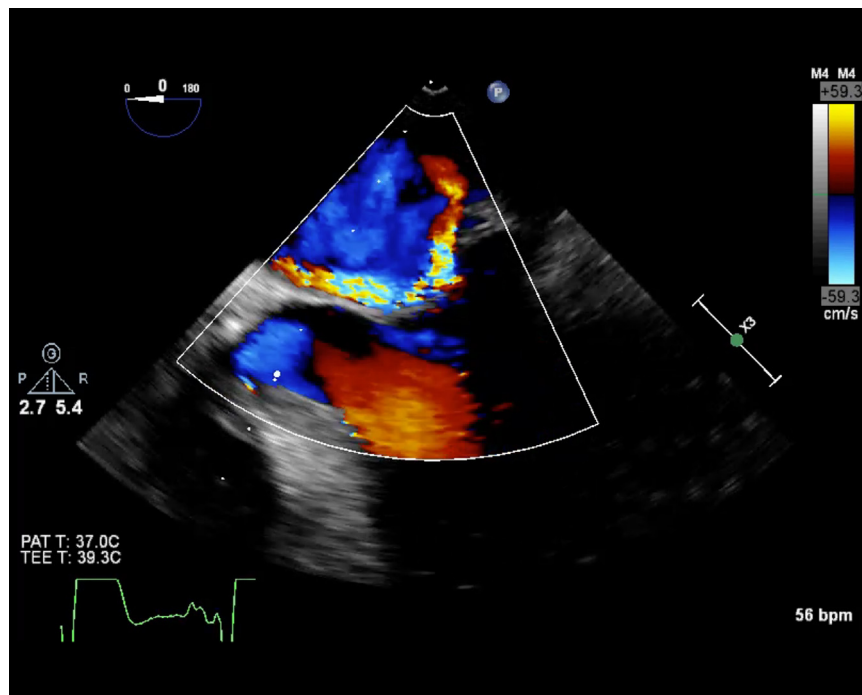


Fig 2. Midesophageal 4-chamber view of the mitral valve with color-flow Doppler demonstrating simultaneous anteriorly and posteriorly directed mitral regurgitation jets.

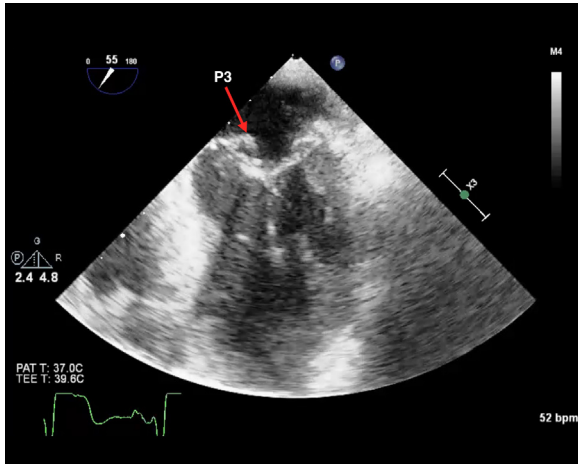


Fig 3. Midesophageal commissural view of the mitral valve with the arrow pointing at P3 prolapse.

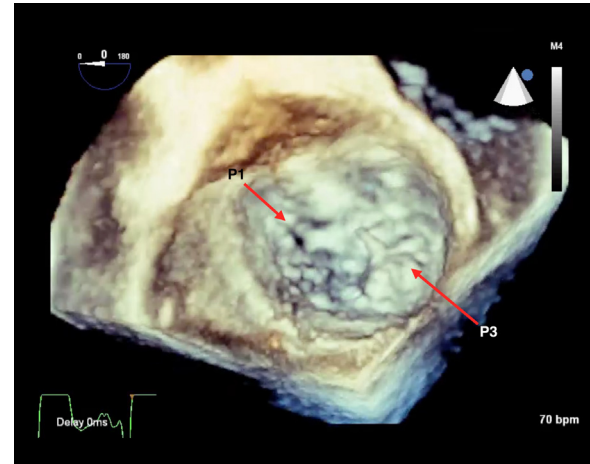


Fig 4. Left atrial enface view of the mitral valve using 3-dimensional transesophageal echocardiography with arrows pointing at restricted P1 and prolapsing P3.

## Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1053/j.jvca.2016.08.027>.

## References

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