Intermittent Entrapment of a Prosthetic Mitral Valve Disc
What You See Is Not What You Get

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A 42-year-old man had undergone mitral valve (MV) replacement 12 years earlier with the use of a CarboMedics bileaflet mechanical prosthesis (Sorin Biomedica). On a routine visit, he was asymptomatic, and cardiac auscultation revealed closing and opening MV clicks. A transthoracic echocardiogram with the use of a 2-beat acquisition protocol showed normal excursion of both MV discs (Figure 1; Movie I in the online-only Data Supplement). Spectral Doppler of transmural flow indicated normal peak gradients; however, abnormalities in the Doppler signal were intermittently noted. Whereas some cardiac cycles showed normal disc motion with near-simultaneous opening clicks, other cycles demonstrated a delay in 1 opening click or a single rather than dual opening clicks (Figure 2). The beats with a single opening click were associated with significant prolongation of the transmural pressure half-time suggestive of obstruction to flow. The abnormalities on spectral Doppler prompted us to reimagine the MV over several cardiac cycles. Intermittent delay in the opening of 1 disc with periodic disc entrapment in a closed position was noted (Figure 3; Movie II in the online-only Data Supplement). Interrogation with color Doppler showed intermittent lack of blood flow across the orifice corresponding to the periodically entrapped disc (Figure 4; Movie III in the online-only Data Supplement). These findings were confirmed by cine fluoroscopy (Figure 5; Movie IV in the online-only Data Supplement). Transesophageal echocardiography did not show any MV thrombi or vegetations. At surgery, a circumferential pannus was identified on the ventricular aspect of the mitral prosthesis impinging on the free margin of the periodically entrapped disc.

Intermittent dysfunction of a prosthetic valve results from periodic interference with disc motion by a pannus, thrombus, or subvalvular tissue. Entrapment leads to delayed disc motion or immobilization in closed or open position resulting in the obstruction to flow or regurgitation, respectively. It is likely that marginal contact between the disc and pannus led to random interference with disc opening and accounts for the intermittent nature of MV dysfunction in our patient. Further pannus growth would likely result in permanent disc entrapment.

Establishing a diagnosis of intermittent prosthetic valve malfunction can be challenging. To reduce memory usage many laboratories acquire and store echocardiography cine loops spanning 1 to 2 cardiac cycles. Abnormal events that occur intermittently can thus be missed.

In our patient, MV malfunction was initially detected by spectral Doppler. This fact underlines the importance of careful analysis of the Doppler signal. Assessment of the presence and timing of valve clicks provides valuable information regarding prosthesis function. A normal transprosthetic gradient does not exclude the presence of MV obstruction especially if this is intermittent; however, prolongation of the pressure half-time is usually evident (Figure 2). Intermittent prosthetic valve dysfunction can have catastrophic consequences and thus requires prompt diagnosis and treatment. Physicians caring for patients with prosthetic valves should be aware of this condition. Sonographers should be encouraged to visualize individual disc motion over several beats before image acquisition.

Disclosures
None.

References

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The online-only Data Supplement is available with this article at http://circ.ahajournals.org/lookup/suppl/doi:10.1161/CIRCULATIONAHA.113.003918/-/DC1.

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Circulation is available at http://circ.ahajournals.org DOI: 10.1161/CIRCULATIONAHA.113.003918
Figure 1. Transthoracic echocardiogram of the mechanical mitral valve prosthesis. Systolic (A) and diastolic frames (B) show normal valve motion with closed discs in systole and fully opened discs in diastole. The discs are indicated by arrows.

Figure 2. Spectral Doppler recording of mitral valve flow. The third beat (indicated by 3) demonstrates normal prosthesis function. The discs show near-simultaneous opening clicks (indicated by arrows) with normal transvalvular gradients (peak/mean gradients = 8/3 mm Hg at heart rate of 59 beats/min), a normal pressure half-time at 100 ms, and an effective mitral orifice area of 2.2 cm². The second beat (indicated by 2) is recorded with 1 disc stuck in a closed position. A single opening click is noted (indicated by arrowhead) with a similar peak but higher mean gradient (peak/mean gradients = 8/5 mm Hg), a significantly longer pressure half-time at 294 ms, and an effective mitral orifice area of 0.7 cm². The first beat (indicated by 1) is recorded when the disc opens late. The Doppler signal shows timely opening click of 1 disc (indicated by a star), delayed opening click of the other disc in mid diastole (indicated by 2 stars), and normal gradients (peak/mean gradients = 7/4 mm Hg). The pressure half-time is prolonged after the first opening click (indicated by a triangle) and shortens (95 ms) after the second opening click. A indicates atrial contraction; and E, early filling phase.

Figure 3. Additional transthoracic images of the mechanical mitral valve prosthesis. A, Systolic frame showing closed discs (indicated by arrows). B, Diastolic frame showing 1 disc in a fully opened position (indicated by arrow), whereas the other disc is stuck in a closed position (indicated by arrowhead).
Figure 4. Color Doppler of mitral valve flow in diastole obtained over 2 consecutive beats. A, On the first beat, both discs are fully opened, resulting in a color flow that spans the entire width of the valve annulus owing to unimpeded flow across both lateral orifices. B, On the second beat, the disc is stuck in a closed position and the origin of the jet is relatively narrow because of the lack of flow across the obstructed orifice (indicated by arrow).

Figure 5. Cine fluoroscopy of the prosthetic mitral valve. A, Diastolic frame showing both mitral discs in a fully opened position (indicated by arrows). B, Diastolic frame from another cardiac cycle showing 1 disc stuck in a mostly closed position (indicated by arrowhead), whereas the other disc is fully opened (indicated by arrow).
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Circulation. 2014;129:e11-e13
doi: 10.1161/CIRCULATIONAHA.113.003918
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/129/2/e11

Data Supplement (unedited) at:
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Movie Legend

**Movie 1.** This movie corresponds to Figure 1. Apical 2-chamber view of a transthoracic echocardiogram with magnification of the mitral valve prosthesis. The movie is recorded over 2 cardiac cycles and shows normal opening and closure of both discs.

**Movie 2.** This movie corresponds to Figure 2 and 3. Apical 2-chamber view of a transthoracic echocardiogram with magnification of the mitral valve prosthesis. The movie is recorded over 3 cardiac cycles. On the first cycle, the disc on the right shows delayed opening. On the second cycle, the same disc is stuck in a closed position. The third cycle shows normal and timely opening of both discs.

**Movie 3.** This movie corresponds to Figure 4.

**Movie 4.** This movie corresponds to Figure 5. Cine fluoroscopy shows that one disc is intermittently stuck in a closed position with intermittent delay in opening.