Unusual transmitral Doppler filling profile induced by right ventricular pacing

Hammam Shereef,¹ Ahmed Subahi ,² Mohit Pahuja,² Luis Afonso²

¹Internal Medicine, Beaumont Hospital Dearborn, Dearborn, Michigan, USA

²Division of Cardiology, Wayne State University/Detroit Medical Center, Detroit, Michigan, USA

Correspondence to

Dr Ahmed Subahi;
asubahi@med.wayne.edu

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DESCRIPTION

An 81-year-old man with a history of complete heart block with a dual-chamber pacemaker was referred to our centre with a suspicion of device malfunction. Device interrogation revealed a normal function with a 79% pacing rate. Continuous-wave (CW) Doppler across mitral inflow revealed a 'triphasic' flow pattern comprising prominent isovolumic relaxation flow (IVRF) signals ([figure 1A](#), green arrows). The IVRF signal is not appreciated with native beats (yellow arrow). Sequential still frame-by-frame analysis of a contrast-enhanced four-chamber view, beginning with left ventricular (LV) early diastole ([figure 1B](#), panels 1 and 2, see red arrowheads for timing of cardiac cycle), showed early relaxation of the apical segments (panel 3), followed by a wavefront of relaxation progressing to the mid-ventricular (panels 4 and 5) and finally basal segments ([figure 1B](#), panel 6). Pulsed-wave Doppler interrogation at the mitral tips was showing a normal biphasic flow pattern (discrete E and A waves) compared with the triphasic flow pattern observed with CW Doppler ([figure 1C](#), top panel). Colour M-mode Doppler showed a prominent apically directed IVRF before mitral valve opening (demarcated by solid yellow line) that is seen blending with early filling (transvalvular) flow,

Figure 1 (A) Continuous-wave Doppler trace across mitral inflow showing a 'triphasic' flow pattern comprising prominent isovolumic relaxation flow signals (green arrows). The isovolumic relaxation flow signal is not appreciated with native beats (yellow arrow). (B) Sequential still frame-by-frame analysis of a contrast-enhanced four-chamber view, beginning with early diastole (panels 1 and 2, see red arrowheads for the timing of cardiac cycle). Note early relaxation of the apical segments (panel 3), followed by a wave front of relaxation progressing to the mid-ventricular (panels 4 and 5) and finally basal segments (panel 6). (C) Top panel: pulsed-wave Doppler interrogation at the mitral tips, showing normal biphasic flow pattern (discrete E and A waves) compared with the triphasic flow pattern observed with continuous-wave Doppler. Bottom panel: colour M-mode Doppler depicting prominent apically directed isovolumic relaxation flow before mitral valve opening (demarcated by the solid yellow line) that is seen blending with early filling (transvalvular) flow, right after mitral valve opening. LV, left ventricle.

Learning points

- ▶ Prominent isovolumic relaxation flow observed with paced beats could be misinterpreted as flow occurring across the mitral valve inflow, based on the continuous-wave Doppler trace alone.
- ▶ Our case highlights the need for echocardiographers to recognise prominent isovolumic relaxation flow and avoid mistaking it for a more widely recognised triphasic flow pattern seen in individuals with diastolic dysfunction (mitral L wave) or tracing over it, which could lead to an overestimation of the transmitral gradient.

right after mitral valve opening ([figure 1C](#), bottom panel). The prominent IVRF observed in our patient could be attributed to an intraventricular pressure gradient caused by LV apical early relaxation due to dyssynchronous LV apex to base contraction–relaxation in patients with right ventricular pacing. However, similar phenomenon has been observed in several conditions, including aortic valve disease, rheumatic heart disease, hypertrophic cardiomyopathy, hypertension, ventricular pre-excitation, coronary artery disease, chronic renal failure and right ventricular pacing, and even in healthy individuals.^{1–5} Furthermore, IVRF can be apically directed, basally directed or bidirectional, occurring during the isovolumic relaxation period.²

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ORCID iD

Ahmed Subahi <http://orcid.org/0000-0003-0384-4164>

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