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EDUCATIONAL CORNER

BEGINNER

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Evanescent Microbubbles After Cardiac Mechanical Support

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ABSTRACT

A 70-year-old man was successfully resuscitated, and an Impella CP was implanted. Transthoracic echocardiography showed acceptable Impella position with noticeable microbubbles in the left ventricle without device alarms. We highlight the appropriate approach in evaluating intracardiac microbubbles in critical care scenarios. (**Level of Difficulty: Beginner.**) (J Am Coll Cardiol Case Rep 2020;2:503–4) © 2020 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/).

What are the sources of microbubbles after mechanical support? A 70-year-old male patient presented with a history of coronary artery disease after a remote ST-segment elevation myocardial infarction with prior percutaneous coronary stenting to the left anterior descending coronary artery. Over the years, he had developed ischemic cardiomyopathy with a reduced ejection fraction (20%), and he underwent cardiac resynchronization therapy followed by milrinone infusion recently, awaiting advanced therapy with a left ventricular assist device. He presented after pulseless electric arrest with successful resuscitation. Cardiac catheterization did not reveal new culprit lesions, but right- and left-sided pressures were elevated. An Impella CP (Danvers, Massachusetts) was placed. Transthoracic echocardiography showed acceptable Impella position, with noticeable microbubbles in the left ventricle without device alarms. Possibilities included cavitation due to inlet obstruction or high flow rates and an intracardiac shunt (**Figure 1A**). No change was noted with Impella repositioning, and saline contrast ruled out shunting. Microbubbles disappeared at lower heart rates and improved intracardiac pressures (**Figure 1B**). Videos 1 and 2 show the appearance and disappearance of microbubbles in the left ventricle.

The presence of microbubbles in the left ventricular cavity has been recognized after mechanical heart valves primarily in the mitral position (1–3). Spontaneous microbubbles are noted in regions of rapid fall and subsequent pressure rise, typically with mechanical valves (1). Technically, this is a short-lived hydrodynamic phenomenon that cannot be detected by transthoracic echocardiography (1,2). Instead, per the carbon dioxide stable degassing principle, the gas separates at this localized pressure decrease, forming small microbubbles that coalesce into larger ones at lower pressure, lasting several seconds and detectable on transthoracic echocardiography (2).

Our patient did not have any mechanical valves but did have an Impella catheter. Moreover, these microbubbles were noted in close proximity to the left ventricular outflow tract and further toward the left ventricular cavity and apex. This could be related to an outflow washing jet arising from catheter malposition, resulting in abnormal outflow jets with or without significant aortic regurgitation splashing the already formed

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, or patient consent where appropriate. For more information, visit the *JACC: Case Reports* author instructions page.

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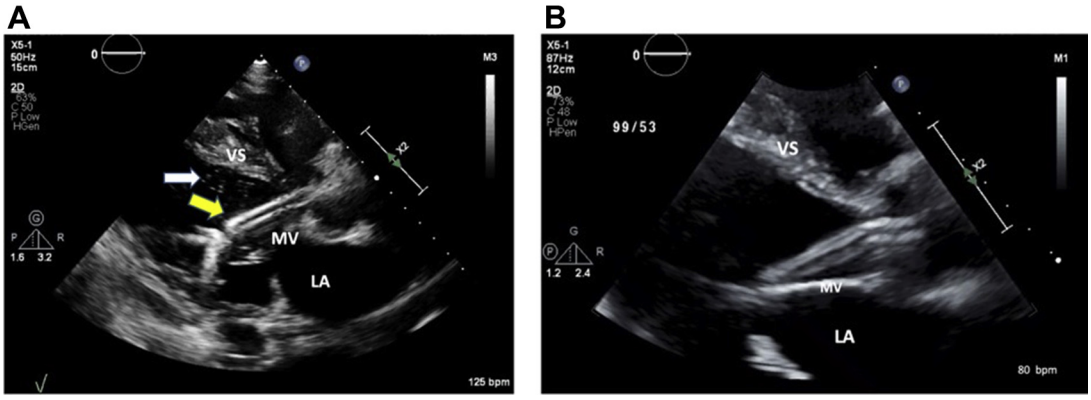
FIGURE 1 Two-Dimensional Transthoracic Echocardiogram Before and After Disappearance of Microbubbles



Two-dimensional echocardiography, parasternal long-axis view, illustrating the position of the Impella catheter **(A, yellow arrow)** and microbubble appearance **(A, white arrow)** and disappearance **(B)** in the left ventricle. LA = left atrium; MV = mitral valve; VS = ventricular septum.

microbubbles toward the apex. However, this was not noted in our patient, with a stable hemodynamic profile and no device alarms. A possible explanation is that during tachycardia, greater cardiac output was generated, resulting in higher closing velocities, which may have augmented the formation of gaseous microbubbles against the Impella catheter in the outflow tract and perhaps migration toward the left ventricular cavity.

Understanding the clinical scenarios in which intracardiac microbubbles can be found in critically ill patients is fundamental. In this patient, tachycardia-related high flow rates likely contributed to evanescent microbubbles. As transcatheter mechanical support becomes more prevalent, microbubbles may be observed due purely to tachycardia in the absence of mechanical complications or intracardiac shunts.

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KEY WORDS bubble echocardiography, echocardiography, systolic heart failure

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