

Images in  
Cardiovascular Medicine



# Defining Coronary Artery Perforation with Ultrasound Contrast Agent

Young Jin Youn , MD, PhD<sup>1</sup>, Salman Khalid , MD<sup>2</sup>, Michael Azrin , MD, PhD<sup>2</sup>, and Juyong Lee , MD, PhD<sup>2</sup>

<sup>1</sup>Division of Cardiology, Department of Internal Medicine, Wonju College of Medicine, Yonsei University, Wonju, Korea

<sup>2</sup>Division of Cardiovascular Medicine, Calhoun Cardiovascular Center, University of Connecticut School of Medicine, Farmington, CT, USA

OPEN ACCESS

**Received:** May 25, 2018

**Revised:** Jun 20, 2018

**Accepted:** Jul 17, 2018

**Correspondence to**

**Michael Azrin, MD**

Division of Cardiovascular Medicine,  
Calhoun Cardiovascular Center, University  
of Connecticut School of Medicine, 263  
Farmington Avenue, Farmington, CT 06030,  
USA.

E-mail: azrin@uchc.edu

Copyright © 2018. The Korean Society of  
Cardiology

This is an Open Access article distributed  
under the terms of the Creative Commons  
Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0>)  
which permits unrestricted noncommercial  
use, distribution, and reproduction in any  
medium, provided the original work is properly  
cited.

**ORCID iDs**

Young Jin Youn

<https://orcid.org/0000-0001-7066-7474>

Salman Khalid

<https://orcid.org/0000-0003-4638-9675>

Michael Azrin

<https://orcid.org/0000-0002-2669-0703>

Juyong Lee

<https://orcid.org/0000-0001-5412-5472>

**Conflict of Interest**

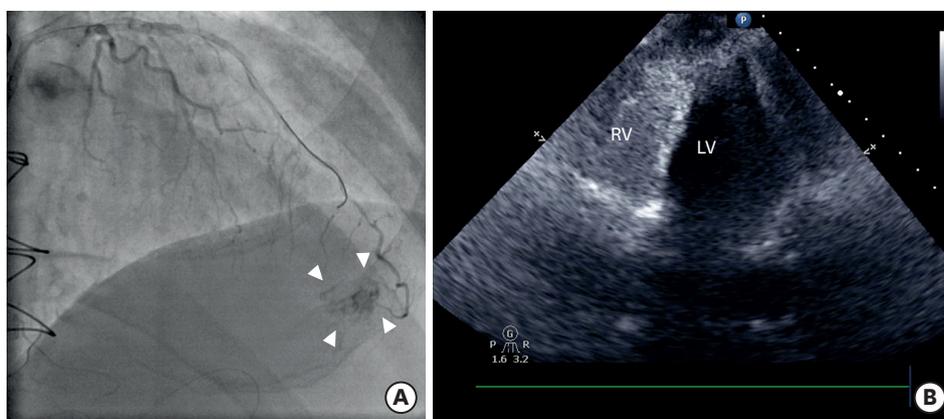
The authors have no financial conflicts of  
interest.

**Author Contributions**

Validation: Azrin M, Khalid S; Visualization: Lee  
J; Writing - original draft: Youn YJ.

After recanalization and stenting a chronic total occlusion of the left anterior descending coronary artery (LAD), coronary artery perforation (CAP) was detected in the LAD (**Figure 1A** and **Supplementary Video 1**), but it was not definitive whether this CAP emptied into the pericardium (Ellis classification III) or into the right ventricle (RV) (Ellis classification III cavity spilling).<sup>1)</sup> Bedside echocardiography showed no definite pericardial effusion. Despite prolonged balloon inflation, spontaneous sealing was not achieved. To define the direction of the CAP, 2 mL of ultrasound contrast agent (UCA), Definity (Lantheus Medical Imaging, North Billerica, MA, USA) was injected into the LAD. The rapid and dense appearance of UCA in the RV on echocardiography confirmed that the CAP was connected to the RV (**Figure 1B** and **Supplementary Video 2**). Because there was felt to be no risk of cardiac tamponade the procedure was completed. The patient was hemodynamically stable at discharge and there were no subsequent complications at 1-month follow-up.

Conservative management for this type of CAP is debated, but only a medium or large sized fistula is considered as a cause of heart failure and myocardial ischemia.<sup>2)</sup>



**Figure 1.** Coronary angiography and contrast echocardiography. (A) Post-stenting angiography shows CAP in the LAD (white arrowheads), but it is not definitive whether this perforation emptied into the pericardium (Ellis classification III) or into the RV (Ellis classification III cavity spilling). (B) After injection of UCA into the LAD, the rapid and dense appearance of UCA in the RV on echocardiography confirms the CAP of Ellis classification III cavity spilling. CAP = coronary artery perforation; LAD = left anterior descending coronary artery; LV = left ventricle; RV = right ventricle; UCA = ultrasound contrast agent.

UCA is used for better endocardial border delineation and assessment of intracardiac blood flow. Recently, the U.S. Food and Drug Administration removed the contraindications for use in patients with cardiac shunts and for administration by intra-arterial injection. Despite a concern about systemic embolization of UCA, several studies have demonstrated the safety<sup>3,4)</sup> and we used only a small amount of UCA in this case. This case illustrates the utility of UAC for the diagnosis of CAP into a ventricular chamber.

## SUPPLEMENTARY MATERIALS

### Supplementary Video 1

Angiography demonstrates perforation of the septal branch of the left anterior descending coronary artery.

[Click here to view](#)

### Supplementary Video 2

Injection of contrast in the septal branch demonstrates dense opacification of the right ventricle and confirms that the exit site of the septal perforation is into the right ventricle and not into the pericardium.

[Click here to view](#)

## REFERENCES

1. Ellis SG, Ajluni S, Arnold AZ, et al. Increased coronary perforation in the new device era. Incidence, classification, management, and outcome. *Circulation* 1994;90:2725-30.  
[PUBMED](#) | [CROSSREF](#)
2. Oreglia JA, Bruschi G, Klugmann S. Percutaneous treatment of iatrogenic left-anterior descending artery to right ventricle fistula. *Catheter Cardiovasc Interv* 2010;76:975-7.  
[PUBMED](#) | [CROSSREF](#)
3. Main ML, Hibberd MG, Ryan A, Lowe TJ, Miller P, Bhat G. Acute mortality in critically ill patients undergoing echocardiography with or without an ultrasound contrast agent. *JACC Cardiovasc Imaging* 2014;7:40-8.  
[PUBMED](#) | [CROSSREF](#)
4. Muskula PR, Main ML. Safety with echocardiographic contrast agents. *Circ Cardiovasc Imaging* 2017;10:e005459.  
[PUBMED](#) | [CROSSREF](#)