

## IMAGING VIGNETTE

### ECG CHALLENGE

# Precordial ST-Segment Elevation

## Anterior Myocardial Infarction or Something Else?



Daisuke Yakabe, MD, Takahiro Mori, MD, Masahiro Araki, MD, Shujiro Inoue, MD, PhD, Toshihiro Nakamura, MD

#### ABSTRACT

The differential diagnosis of ST-segment elevation on electrocardiogram is multifaceted. Particularly, in cases of precordial ST-segment elevation, considering anterior myocardial infarction is crucial. Herein, we present a case of precordial ST-segment elevation with normal left coronary arteries. (J Am Coll Cardiol Case Rep 2024;29:102150) © 2024 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/>).

An 83-year-old man with a history of paroxysmal atrial fibrillation presented to the emergency department with sudden-onset chest discomfort. On arrival, his vital signs were blood pressure 171/99 mm Hg, heart rate 95 beats/min with a regular rhythm, oxygen saturation 98% on room air, and body temperature 36.2 °C. Physical examination revealed no signs of heart failure or audible cardiac murmur. Chest radiography revealed no cardiac enlargement or pulmonary congestion. Echocardiography revealed normal left ventricular ejection fraction without wall-motion abnormalities. **Figure 1A** shows a 12-lead electrocardiogram (ECG). What was the most likely diagnosis?

- A. Anterior myocardial infarction
- B. Right ventricular myocardial infarction
- C. Acute pericarditis
- D. Takotsubo cardiomyopathy

#### DISCUSSION

The presented ECG shows sinus rhythm with a heart rate of 83 beats/min, a narrow QRS complex with left-axis deviation, and ST-segment elevation in the precordial leads (highest in V<sub>2</sub>). The P waves in lead II were bifid and wide (128 milliseconds), suggesting left atrial enlargement. Reciprocal changes in the inferior leads and decreased R-wave amplitudes in the precordial leads were not observed. Anterior myocardial infarction (MI) was initially considered, leading to emergent coronary angiography, which revealed no evidence of ischemia in the left coronary arteries; however, occlusion of the right ventricular (RV) branch (**Figures 2A and 2B**) was identified. Although balloon angioplasty using a 1.5-mm balloon successfully achieved reperfusion and mitigated ST-segment elevation, the procedure ultimately failed because of recoiling. Subsequent right-sided ECG

From the National Hospital Organization Kyushu Medical Center, Fukuoka, Japan.

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, including patient consent where appropriate. For more information, visit the [Author Center](#).

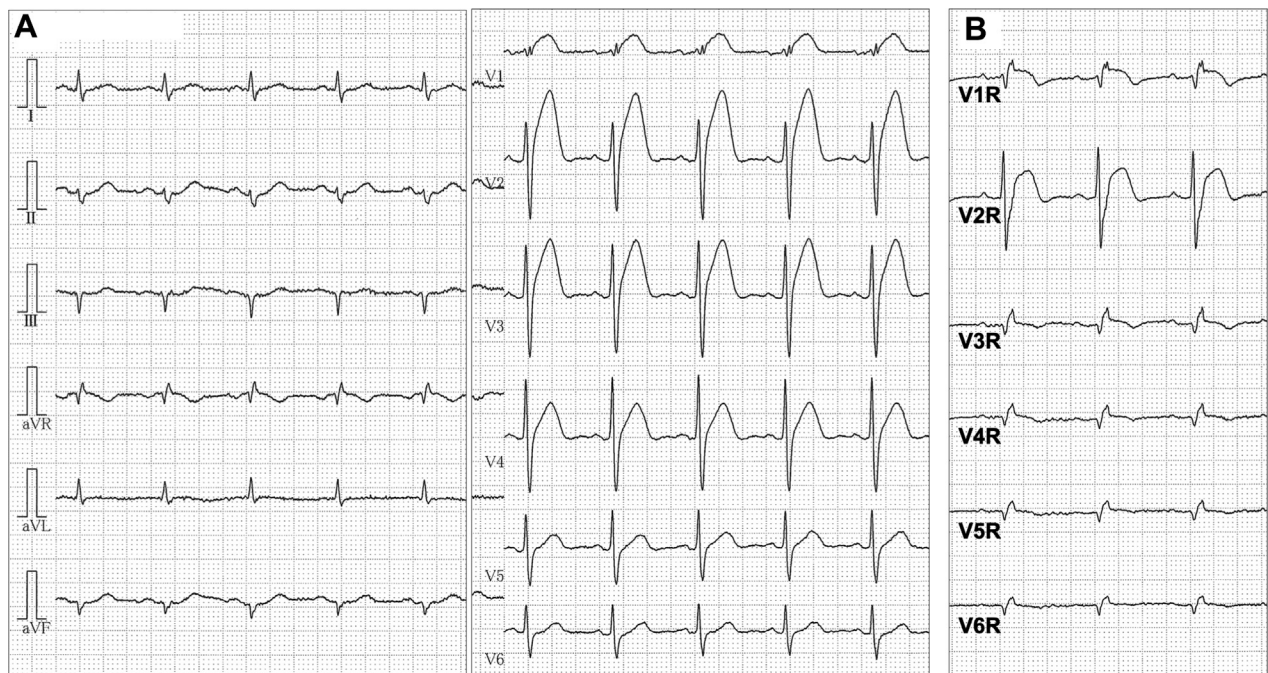
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**ABBREVIATIONS  
AND ACRONYMS**

**ECG** = electrocardiogram  
**MI** = myocardial infarction  
**RV** = right ventricle

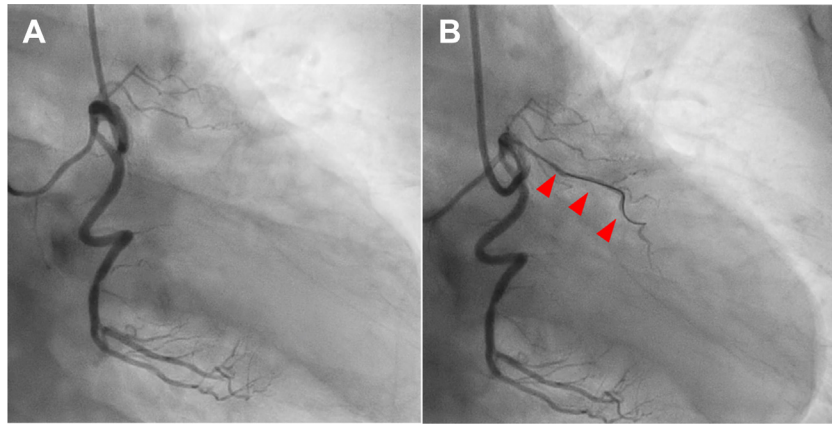
recordings after coronary intervention showed ST-segment elevation in V<sub>1</sub>R-V<sub>2</sub>R, but V<sub>4</sub>R exhibited no ST-segment change (Figure 1B). Throughout hospitalization, no signs of right-sided heart failure or sinus node dysfunction were observed. Cardiac magnetic resonance revealed diffuse late gadolinium enhancement in the RV (Figure 3). Therefore, the answer is B (right ventricular myocardial infarction).

Isolated RVMI is exceedingly rare, with autopsy reports suggesting an incidence <3%.<sup>1</sup> A publications review revealed that the etiology of isolated RVMI consists of 2 main patterns: occlusion of the nondominant right coronary artery or sole occlusion of the RV branch.<sup>2</sup> Precordial ST-segment elevation is a common feature in these cases. Differential diagnosis is critical because ST-segment elevation in the precordial leads can often occur in cases of anterior MI. However, the highest ST-segment elevation in precordial leads V<sub>1</sub>-V<sub>2</sub>, along with the absence of a decreased R-wave and reciprocal changes, makes the diagnosis of anterior MI less likely. The limited distribution of nonconcave ST-segment elevation is atypical in acute pericarditis. Takotsubo cardiomyopathy often presents with ST-segment depression in aVR and no ST-segment changes in V<sub>1</sub>, thus making it an unlikely diagnosis.<sup>3</sup> Diagnosing isolated RVMI based solely on the ECG is challenging, and coronary angiography is necessary not only to confirm the diagnosis, but also to rule out more severe anterior MI. However, severe cases of RVMI with hemodynamic instability have also been reported.<sup>2</sup> Therefore, when a patient presents with unstable hemodynamics and precordial ST-segment elevation despite angiographically normal left coronary arteries, consideration of RV infarction is essential.

**FIGURE 1** Electrocardiogram

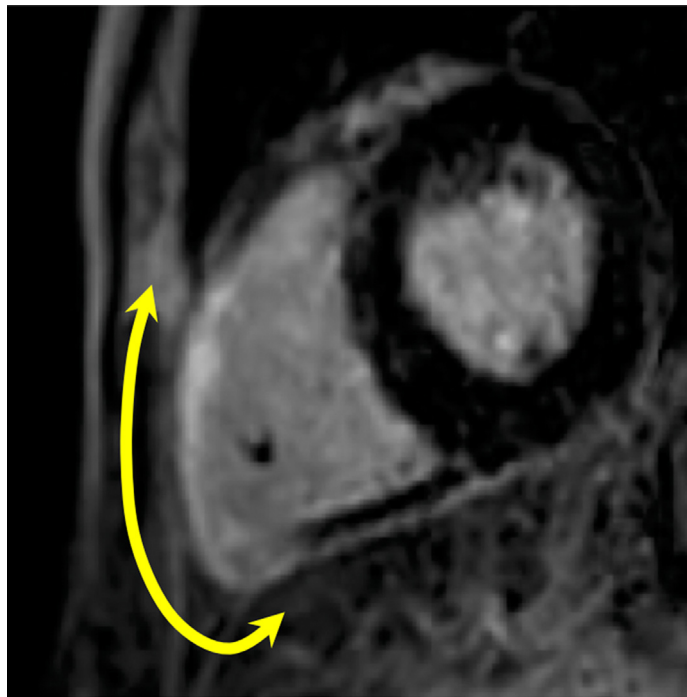
The 12-lead ECG on arrival (A) and after coronary intervention (B).

**FIGURE 2** Coronary Angiography



Coronary angiography demonstrating occlusion of the right ventricular branch (A) and successful reperfusion after balloon angioplasty (B, red arrows).

**FIGURE 3** Cardiac Magnetic Resonance



Cardiac magnetic resonance revealed diffuse late gadolinium enhancement (yellow arrow) in the right ventricle.

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**ADDRESS FOR CORRESPONDENCE:** Dr Daisuke Yakabe, National Hospital Organization Kyushu Medical Center, 1-8-1, Jigyohama, Chuo-ku, Fukuoka City 810-8563, Japan. E-mail: [@yakabedaisuke@gmail.com](mailto:yakabedaisuke@gmail.com).  
[@yakabe1206](mailto:yakabe1206).

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**KEY WORDS** acute coronary syndrome, coronary angiography, electrocardiogram, myocardial infarction, right ventricle