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# Reverse perfusion–metabolism mismatch on scintigraphy in refractory coronary spastic angina

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## Abstract

The perfusion–metabolism mismatch observed on scintigraphy is useful for identifying ischemic regions as "ischemic memory," particularly during the acute phase following an ischemic insult. However, a reverse perfusion–metabolism mismatch may occur under extremely rare conditions, as demonstrated in this case of refractory coronary spastic angina.

## Case Description

A 78-year-old man presented with transient epigastric pain that had started 10 days earlier. His medical history included emphysema, hypertension, and dyslipidemia. On admission, vital signs were normal except for severe bradycardia (heart rate, 35 beats/min). Electrocardiography showed complete atrioventricular block with ST-segment elevation in leads II, III, aVF, and V5–V6 (Panels A and B). Chest radiography showed no cardiomegaly or pleural effusion. Transthoracic echocardiography was non-diagnostic, likely due to emphysema. Laboratory testing revealed elevated creatine kinase (449 U/L) and high-sensitivity troponin T (0.084 ng/mL).

Emergency coronary angiography, performed after temporary pacemaker insertion, showed no significant stenosis in the left coronary artery but severe stenosis in the mid-right coronary artery. Intracoronary nitroglycerin did not relieve the stenosis; however, the lesion resolved after guidewire passage for percutaneous coronary intervention and did not recur after guidewire withdrawal, with restoration of normal atrioventricular conduction. Coronary spastic angina was diagnosed.

After admission to the intensive care unit, the patient developed recurrent ST-segment elevation (Panels A and B) with hypotension due to coronary artery spasm refractory to standard therapy. The condition was controlled with intravenous methylprednisolone, midazolam sedation, and continuous

norepinephrine infusion.

Bull's-eye maps of myocardial perfusion obtained 20 days later showed reduced tracer uptake in the inferior region on thallium-201 imaging (Panel C) with preserved uptake on $^{123}$I-β-Methyl-p-Iodophenyl-Pentadecanoic acid (BMIPP) imaging (Panel D). This extremely rare finding, termed reverse mismatch [1], was confirmed by single-photon emission computed tomography, including vertical long-axis (Panel E) and short-axis (Panel F) views.

In myocardial ischemia, BMIPP typically shows reduced uptake relative to perfusion tracers such as thallium-201, reflecting impaired fatty acid metabolism in ischemic but viable myocardium [1]. This perfusion–metabolism mismatch has been shown to be useful for identifying ischemic regions as "ischemic memory," particularly during the acute phase following an ischemic insult [2]. However, under conditions of acute ischemia and early reperfusion, experimental models have demonstrated a paradoxical pattern in which BMIPP uptake is preserved or exceeds that of perfusion tracers, a phenomenon termed reverse mismatch [1]. Although the underlying mechanism remains incompletely understood, acute ischemia rapidly suppresses mitochondrial β-oxidation owing to limited oxygen availability, resulting in fatty acid accumulation within an enlarged triglyceride pool induced by transient severe ischemia [3].

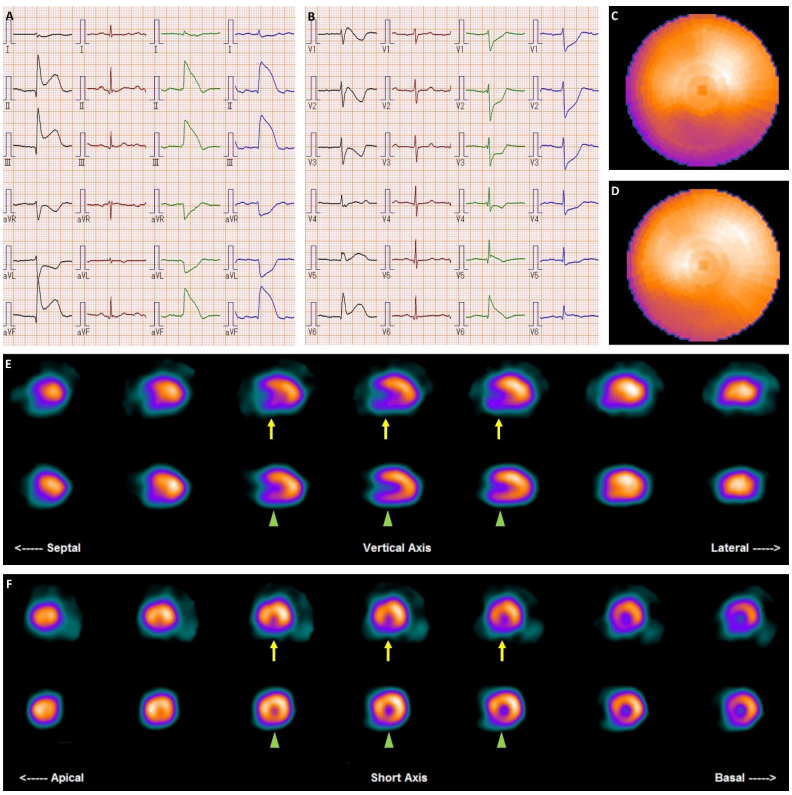


**Figure 1:** Electrocardiography **(Panels A and B)** shows ST-segment elevation predominantly in the inferior leads on admission (black traces). The ST-segment elevation resolved completely after cardiac catheterization, or within 30 min of presentation (brown traces). Recurrent ST-segment elevation refractory to medical therapy subsequently developed in the intensive care unit, including at 4.5 h (green traces) and 7.5 h (blue traces) after presentation. Bull's-eye maps of myocardial perfusion imaging obtained 20 days after admission show reduced tracer uptake in the inferior wall on thallium-201 imaging **(Panel C)** with preserved uptake on $^{123}$I-β-Methyl-P-Iodophenyl-Pentadecanoic acid (BMIPP) imaging **(Panel D)**. This reverse perfusion–metabolism mismatch was confirmed by single-photon emission computed tomography: vertical long-axis **(Panel E)** and short-axis **(Panel F)** images show reduced thallium-201 uptake in the inferior region (upper images, yellow arrows), whereas BMIPP uptake is preserved (lower images, green arrowheads).

**Authors contribution:** Sakiko Honda – writing original draft - Lead Author; Tatsuya Kawasaki - reviewing and editing - Supporting.

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