

Kugel's Artery as a Rare Intracoronary Collateralization Does Not Effectively Guarantee the Presence of Viable Hibernating Myocardium

Abstract

In this note, it was aimed to describe a 66-year-old patient for ischemia evaluation following the episodes of chest discomfort using dipyridamole stress-rest myocardial perfusion single-photon emission computed tomography (SPECT). Invasive coronary angiography demonstrated a total occlusion of the right coronary artery (RCA) and prominent RCA intracoronary collateral (Kugel's artery) associated with nonviable, infarcted myocardium in the inferior wall of left ventricular LV on myocardial perfusion SPECT. Thus, recanalization of RCA was not performed in our patient. It is concluded that performing complementary imaging modalities for assessing myocardial perfusion like SPECT for the prediction of viability to sole reliance on angiographic data in decision making for revascularization is encouraged.

Keywords: Kugel's artery, nonviable myocardium, right coronary artery intracoronary collateral

Figure 1: A 66-year-old patient with a history of percutaneous coronary intervention and stent placement in the right coronary artery (RCA) and left circumflex (LCX) a few years ago was referred to our laboratory for ischemia evaluation following the episodes of chest discomfort using dipyridamole stress-rest myocardial perfusion single-photon emission computed tomography (SPECT). After obtaining an informed consent, myocardial perfusion scintigraphy was done. The invasive angiography shortly prior demonstrated the presence of significant in-stent stenosis in the LCX (small arrow) and the total occlusion of RCA with development of a Kugel's artery (arrowheads) as a prominent long tortuous collateral vessel connecting the proximal and distal parts of RCA bypassing the obstructed segment. Six-lead electrocardiogram (upper panel) of the patient demonstrates the inversion of T waves and a significant Q wave in the leads II, III, and aVF. The invasive coronary angiography displays a significant lesion in the LCX (small arrow) as well as totally occluded RCA (long arrow). Additionally, a long and tortuous collateral, the so-called Kugel's artery, is seen with sufficient contrast filling (showed by arrowheads).

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It is originated from the proximal part of RCA and then, connects to the distal part.

Figure 2: Short- and vertical long-axis tomographic slices (upper and middle panels, respectively) of stress and rest images of myocardial perfusion SPECT demonstrate a severe fixed perfusion defect of the inferior/inferolateral walls. Three-dimensional display of LV (lower panel, left) shows considerable remodeling. Severe hypokinesia/akinesia of the inferior wall and low LV global ejection fraction are also seen in motion polar plot and time-volume curve (lower panel, middle, and right). In the setting of reduced blood flow to the myocardium, mostly as a result of chronic atherosclerotic disease of the epicardial coronary arteries or their main branches, a network of small-diameter vessels, termed as coronary collateral circulation, is developed with self-protective intents against ischemia. The anatomical and physiological properties of these vessels are, to a varying degree, different from those of the native arteries. Maturation of poorly formed capillary-like vessels to well-developed ones, in addition to expansion of preexisting collateral connections, following a decreased oxygen supply in the situations of chronic total occlusion, is a major feature of collateral vasculature. Bi-directionality of flow

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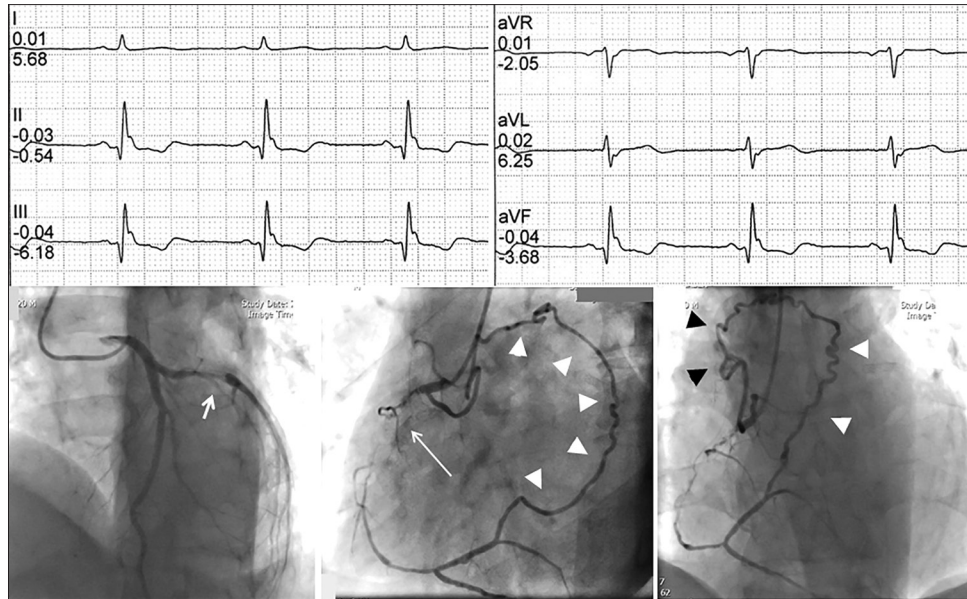


Figure 1: The 6-lead ECG (upper panel) and invasive coronary angiography (lower panel)

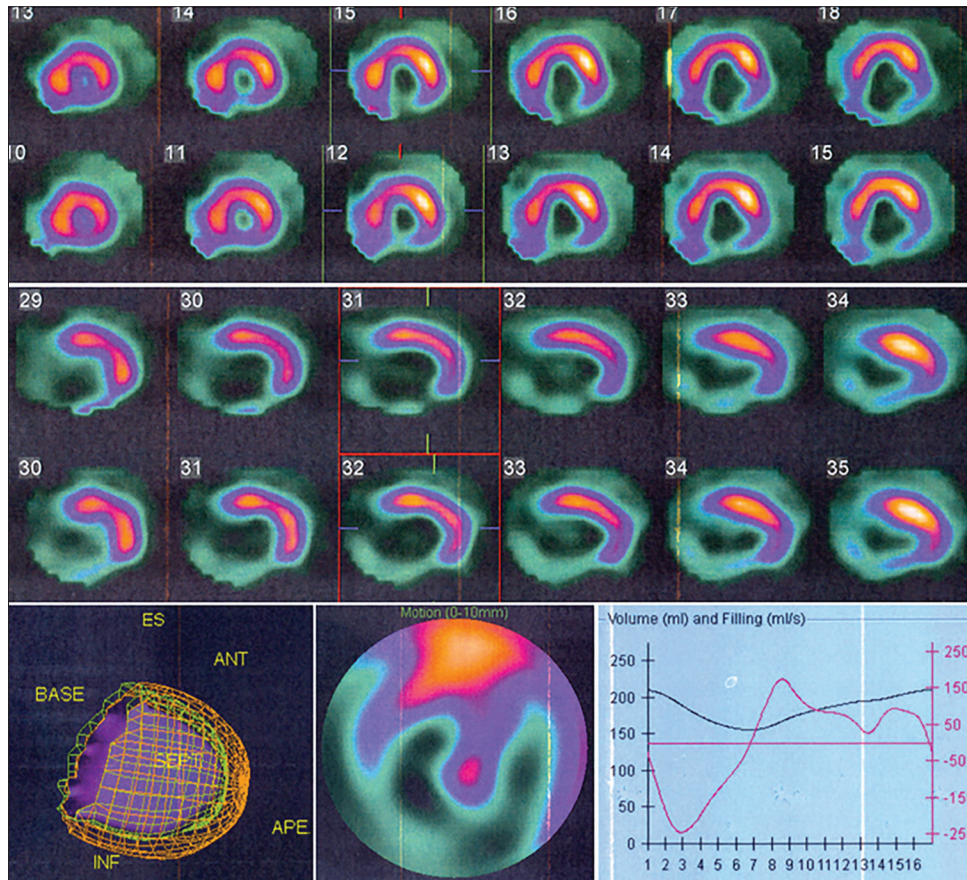


Figure 2: The tomographic slices of myocardial perfusion SPECT imaging in stress and rest phases (upper and middle panels) and the results of gated study (lower panel) as three-dimensional display, polar plot of motion and time-volume curve

based on resistance-pressure relationships allows inter- or intracoronary bypassing of obstructed segment to maintain blood flow to jeopardized myocardium distal to stenosis.^[1,2] Kugel's artery as a less frequent, specified form of collateral vessels with a several anatomical variants has long been

introduced and characterized. A variant in right-dominant hearts, like that in our patient, is one that originates from the proximal RCA, near the ostia, that goes through the atrioventricular groove, and then, along the interatrial septum. Finally, near the crux cordis, it joins the distal

part of the RCA to create a natural intracoronary bypass connecting the proximal and distal parts of the RCA.^[3-5] From pathophysiological point of view, in the presence of chronic total occlusion, due to the undersupplying of the myocardium even in low-workload or resting conditions as well as the cumulative detrimental effects of possible repeated ischemic episodes, the myocardium in jeopardy may become infarcted or encounter a process of hibernation. In such circumstances, a major issue that has always been of interest is whether the patient gains benefits from revascularization, despite its technical difficulty, and amount of success in recanalization due to irreversible adverse remodeling. Existence of viable myocardium is the main criteria in taking decision. Some studies have investigated the association of the presence of collateral circulation with myocardial viability, in which a weak correlation and a poor predictive performance have been observed. So that, noninvasive myocardial perfusion imaging is necessary before revascularization of chronic total occlusion. More interestingly, the absence of collateralization does not exclude myocardial viability.^[1,6-8] Apart from the overall impact of collateral circulation, the functional significance of Kugel's artery as a specified collateral vessel in keeping the myocardium sustainable and warranting the presence of viable myocardium has not been demonstrated. In this case, whose collateral vessel (Kugel's artery) was angiographically confirmed; the stress rest myocardial perfusion SPECT displayed a fixed defect indicating scar. However, as thallium-201 viability imaging was not performed, the possible concomitant presence of hibernating myocardium cannot be determined. Recanalization of the RCA was not performed in our patient, even though recanalization is possible following a retrograde approach in some cases with prominent collateral.^[9] Collectively, performing complementary imaging modalities for assessing myocardial perfusion like SPECT for the prediction of viability to sole reliance on angiographic data in decision making for revascularization is encouraged.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have

given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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