

Multivessel disease, a challenging diagnosis. Case report and review of the literature

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Abstract

Multivessel disease is characterized by significant atherosclerotic changes in all three main epicardial coronary arteries. It is a high-risk coronary syndrome that is associated with an important increase in cardiovascular mortality. A 76-year-old female was referred to our department due to chest pain. The coronary angiography showed multivessel disease. Despite the superior diagnostic performance of nuclear imaging techniques, multivessel disease remains a challenging diagnosis. Since all three major coronary arteries had a similar degree of stenosis, the radiotracer had an homologous uptake. Pseudonormalization in MPI-gated SPECT is usually found in multivessel disease, consequently, an anatomical assessment is usually necessary.

Introduction

Multivessel disease is a high-risk coronary syndrome in which there is a stenosis of 70% or more in each major epicardial coronary artery [1]. Atherosclerosis is the main mechanism responsible for such stenosis, and the main risk factors associated with this entity are hypertension, diabetes, hypercholesterolemia, and smoking. This disease carries a high risk of mortality and morbidity in both stable and unstable clinical settings; its poor prognosis may improve in patients when performing percutaneous or surgical revascularization -- depending on their clinical characteristics -- often these invasive interventions are not performed due to patient's risk underestimation [2].

Case report

A 76-year-old female was referred due to chest pain. She had hypertension, diabetes and dyslipidemia diagnosed 20 years ago.

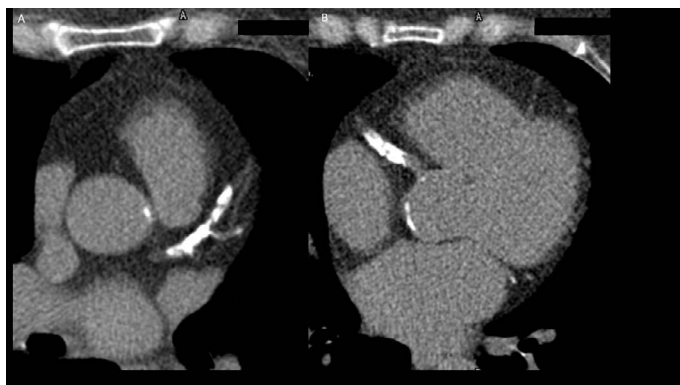


Figure 1. Coronary Calcium Score by computed tomography

An important calcification is present in the left main coronary artery, involving left anterior descending, circumflex artery (A), and right coronary artery (B). Coronary Calcium Score was 2149.2 UA

Physical examination was irrelevant and laboratory studies showed total cholesterol of 135 mg/dL and triglycerides of 155 mg/dL. A coronary angiotomography showed diffuse multivessel coronary artery disease (CAD) CAD RADS 5, with a calcium score of 2149.2 U (Figure 1). The coronary angiography showed multivessel disease with 90% stenosis of the left anterior descending artery, 80% stenosis of the first diagonal artery, presence of crystals of cholesterol in the circumflex artery and 90% stenosis of the right coronary artery (Figure 2). A transthoracic echocardiogram showed left ventricular normal wall motion and normal left ventricular systolic function.

Further diagnostic tests were performed to evaluate ischemia-guided revascularization. Pharmacological stress test was positive for ischemia and perfusion study with 99m Tc-Sestamibi gated-SPECT showed a nontransmural infarction of the lateral wall and generalized ischemia of the left ventricle that caused "pseudonormalization" of perfusion, also called balanced ischemia (Figure 3).

Discussion

Multivessel disease presents in 20-30% of individuals with obstructive CAD and imparts an approximately 2-fold risk of death. This entity's definition varies in the literature, some authors define it as an angiographically visible stenosis of $\geq 50\%$ in all three main epicardial coronary arteries, with or without involvement of the left

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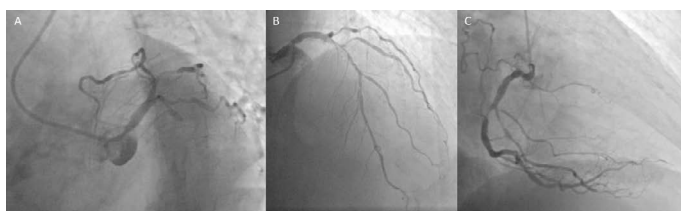


Figure 2. Coronary angiography

Panel A shows a 50% stenosis in the proximal segment of the left coronary trunk and a chronic total occlusion of the circumflex artery. Panel B shows a 90% stenosis at the proximal portion of the left anterior descending artery and an 80% stenosis in the first diagonal artery. Panel C exhibits a 90% stenosis at the mid portion of the right coronary artery

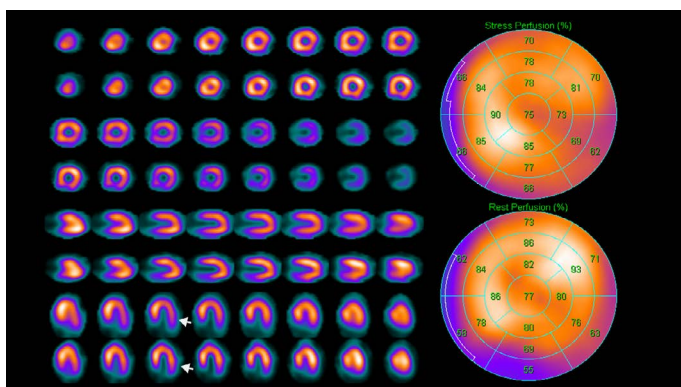


Figure 3. MPI-gated SPECT

A small non-transmural infarction is present in the lateral wall with mild ischemia of the residual tissue (circumflex territory). These findings suggest pseudonormalization of the left ventricular perfusion (balanced ischemia)

main artery [1], while others mention that when each major epicardial coronary artery has a stenosis of $\geq 70\%$, the illness is diagnosed [2].

In a context of multivessel coronary artery disease, it might be difficult to recognize lesions as hemodynamically significant for a future revascularization. The use of coronary physiological testing through fractional flow reserve is beneficial in multivessel disease, especially when the findings between the coronary angiogram and the stress echocardiogram are discordant. When compared to stress test findings, positive (0.75) and negative (>0.8) fractional flow reserve values are stated to have an accuracy of $>90\%$ [3-5].

Regarding diagnostic tests in our patient, invasive coronary angiography confirmed multivessel disease. Likewise, evidence suggestive of ischemia was found on exercise ECG (EECG); however, myocardial perfusion imaging (MPI) gated SPECT showed “pseudonormalization” of left ventricular perfusion as a result of globalized ischemia.

The diagnostic accuracy of cardiac stress tests has significantly increased as a result of the combination of exercise ECG testing with MPI-gated SPECT during the last few years [6,7].

The Coronary Artery Disease Reporting and Data System (CAD-RADS) establishes a standard categorization of CAD, it includes information regarding the degree of stenosis, plaque features, image quality, stents, and/ or coronary artery bypass grafts acquired from CCTA. Our patient was given a CAD-RADS 5, because she had a chronic total occlusion of the anterior descending coronary artery, requiring invasive coronary angiography and/or viability evaluation. For CAD-RADS classifications 4 and 5, myocardial revascularization is suggested, which imply the need for hospitalization and consultation with a cardiologist [8].

MPI-SPECT is currently one of the most sensitive diagnostic tools in the diagnosis of CAD [9]. However, the literature reports cases of patients with multivessel coronary disease confirmed through coronary angiography, who obtained normal MPI-SPECT results (false negative) and true positives in exercise electrocardiogram testing [10-13].

This case illustrates a well-known phenomenon called balanced ischemia, since all three major coronary arteries have a similar degree of stenosis, the radiotracer used in the study will have homologous uptake in all regions of the myocardium as a result of the globalized hypoperfusion [12,14].

Conclusions

Despite the superior diagnostic performance of nuclear imaging techniques, multivessel disease remains a challenging diagnosis. This disease is more frequent in patients with diabetes and is often underdiagnosed. Pseudonormalization in MPI-gated SPECT is a suggestive pattern found when multivessel disease is present. An anatomical assessment — in this case, an angiography — may help in these circumstances to guide the diagnosis and treatment options. Current guidelines recommend coronary artery bypass graft as the first-line treatment option in patients with CAD and diabetes, due to reduced mortality compared to percutaneous coronary interventions.

Disclosures

The authors declare no conflicts of interest.

Fundings

None.

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