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CASE REPORT

Decision Making in Intermediate Coronary Lesion via DFR Guided Percutaneous Intervention.

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Abstract

Background: Physiologic assessment is widely utilized in clinical practice, particularly in the context of coronary artery disease (CAD). Various intravascular pressure measurement techniques exist, each with its own limitations. However, the diastolic hyperemia-free ratio (DFR) has shown significant clinical usefulness. DFR calculates the diastolic portion of the cardiac cycle at rest, utilizing a cutoff value of 0.89. The DFR window employs two criteria: Pulmonary Artery (PA) < Mean PA and a downsloping PA. The selection of the wave-free period is unnecessary for obtaining accurate results.

Case Presentation: This case report presents the application of DFR in the assessment of a 67-year-old male patient with an intermediate severity lesion in the left anterior descending artery.

Management and Result: The patient underwent physiologic assessment using DFR to evaluate the lesion in the left anterior descending artery. The DFR measurement indicated an intermediate severity of the lesion. Subsequent management decisions were made based on the DFR findings.

Conclusion: The utilization of DFR in the physiologic assessment of coronary artery disease has demonstrated clinical usefulness. This case report highlights its application in assessing an intermediate severity lesion in the left anterior descending artery. DFR provides valuable information for guiding management decisions in such cases. Further research and clinical experience are necessary to fully establish the utility of DFR in the assessment and management of coronary artery disease.

Keywords

DFR, Diastolic Portion, Wave Free Period, Left Anterior Descending Artery, Intermediate Severity Lesion, PCI.

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Introduction

Coronary artery disease (CAD) remains a leading cause of morbidity and mortality worldwide. It is characterized by the presence of atherosclerotic plaques within the coronary arteries, which can restrict blood flow and lead to myocardial ischemia. The management of CAD often involves the evaluation of coronary lesions to determine their significance and guide treatment decisions[1].

Traditionally, invasive coronary angiography has been the gold standard for assessing the severity of coronary lesions. However, it provides only anatomical information and may not accurately reflect the functional significance of a lesion. In recent years, physiological indices derived from pressure wire measurements have emerged as valuable tools in assessing lesion severity and guiding treatment strategies[2].

Among these indices, the instantaneous wave-Free Ratio (iFR) has gained popularity. iFR measures the ratio of distal coronary pressure to aortic pressure during a specific diastolic period of the cardiac cycle, known as the wave-free period. It provides a reliable assessment of lesion significance without the need for adenosine-induced hyperemia, making it more convenient and less time-consuming than other invasive tests[2,3].

While iFR has proven to be effective, it still requires the identification of the dicrotic notch on the pressure wave and an electrocardiogram (ECG) signal. This dependence on the ECG can be limiting in certain clinical scenarios, such as in patients with arrhythmias or those unable to undergo ECG monitoring[3].

To address these limitations, an alternative index called the Diastolic Fraction Reserve (DFR) has been developed. DFR incorporates five heartbeats to calculate the diastolic portion of the cardiac cycle at rest, without relying on the ECG signal. It utilizes the mean arterial pressure and the diastolic wave-free period to assess lesion severity, with a cutoff value of 0.89 regardless of the diastolic period considered.

Previous studies, including the pooled analysis of CONTRAST and VERIFY 2, have shown that DFR is as accurate as iFR in evaluating lesion severity. In fact, DFR values have been found to be equivalent to iFR, with a high diagnostic accuracy, sensitivity[4], and specificity. The advantage of DFR lies in its independence from the ECG signal, its incorporation of multiple heartbeats, and its ability to determine lesion significance without the need to identify the dicrotic notch on the pressure wave.

In this case study, we aim to demonstrate the clinical utility of DFR in assessing intermediate severity coronary lesions. We present a patient with a coronary lesion of moderate severity and utilize DFR to evaluate its significance. By comparing the DFR values obtained with the lesion in close proximity and at rest, we determine whether the lesion induces pronounced ischemia in the myocardium. This information will guide our treatment decision, either recommending guideline-directed optimal medical therapy or considering the need for stenting of the lesion.

Through this case study, we aim to highlight the advantages of DFR over traditional methods and emphasize its potential as a reliable and ECG-independent tool in the assessment of coronary lesions.

Case Presentation

A 67-year-old male patient with a known history of hypertension presents with typical chest pain. The patient's angina symptoms are classified as Grade II/III according to the Canadian Cardiovascular Society (CCS) grading system. The initial electrocardiogram (ECG) shows a normal sinus rhythm with left axis deviation and left ventricular hypertrophy based on voltage criteria. A transthoracic echocardiogram (ECHO) reveals preserved left ventricular systolic function with left ventricular hypertrophy, indicated by an ejection fraction of 60%. Considering the patient's clinical presentation and diagnostic findings, a screening angiography was recommended, and the patient

was admitted to the cardiac catheterization laboratory (Cath lab) for further evaluation.

Management & Results

Using a 6 Fr Tiger catheter via a right radial approach, the left coronary system was engaged during the coronary angiography. The angiogram revealed an intermediate-type lesion (>40% but <70%) in the mid-portion of the left anterior descending (LAD) artery. Based on the severity criteria, this lesion falls within the intermediate range. The decision whether to proceed with percutaneous coronary intervention (PCI) or follow guidelines for optimal medical therapy was made based on the fractional flow reserve (FFR) value.

Furthermore, an ostial lesion of moderate intensity was observed in the first diagonal branch of the LAD artery, while the right coronary artery system appeared normal and dominant.

Figure 1: DFR procedure done showing negative results for significant ischemia

Discussion

The DFR (Diastolic Fraction Reserve) calculation is used to determine the diastolic portion of the cardiac cycle at rest, utilizing a cutoff value of 0.89. The pooled analysis of CONTRAST and VERIFY 2 studies demonstrates that DFR is comparable in accuracy to iFR (instantaneous wave-Free Ratio), with DFR values being equivalent to iFR. Notably, DFR exhibits a high diagnostic accuracy of 98%, with a sensitivity of 96% and specificity of 99%. DFR relies on two criteria: aortic pressure (Pa) lower than mean Pa and a downsloping Pa. One of the major advantages of DFR is its independence from an ECG signal, as it incorporates five heartbeats for analysis. Additionally, DFR does not require identification of the dicrotic notch of the pressure wave. It utilizes the mean arterial pressure and the diastolic wave-free period, employing a cutoff value of 0.89, regardless of the diastolic period under consideration.

The assessment of coronary lesions involves the use of a pressure wire, which is initially equilibrated with air and then inserted into the coronary artery under investigation. The wire is passed beyond the lesion, and the values are verified to ensure they remain at a zero reference level. Gradually withdrawing the pressure wire towards the lesion, the recorded values decrease from 1 to 0.98, 0.97, 0.95 and 0.94. Based on these findings, it can be concluded that the lesion does not induce significant ischemia in the myocardium, suggesting that the patient can proceed with guidelines-directed optimal medical therapy rather than undergoing stent placement to address the lesion.

Conclusion

In summary, our case study highlights the preferential use of pressure studies to evaluate the significance of intermediate severity coronary lesions rather than opting for immediate intervention. DFR, a reliable and ECG-independent method, offers diagnostic accuracy similar to iFR. By employing the pressure wire technique and assessing the diminishing values in close proximity to the lesion, we can determine whether the lesion is significant enough to cause myocardial ischemia. Based on our findings, patients in such cases can benefit from guidelines-directed optimal medical therapy, negating the need for immediate stenting.

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