

## Editorial



# Brightening Your Vision With Fractional Flow Reserve and Intravascular Ultrasound

Jung-Joon Cha , MD, PhD, and Soon Jun Hong , MD, PhD

Department of Cardiology, Cardiovascular Center, Korea University Anam Hospital, Korea University College of Medicine, Seoul, Korea

## OPEN ACCESS

**Received:** Jun 29, 2024

**Accepted:** Jul 1, 2024

**Published online:** Jul 8, 2024

### Correspondence to

Soon Jun Hong, MD, PhD

Department of Cardiology, Cardiovascular Center, Korea University Anam Hospital, Korea University College of Medicine, 73, Goryeodae-ro, Seongbuk-gu, Seoul 02841, Korea.  
Email: psyche94@gmail.com

Copyright © 2024. The Korean Society of Cardiology

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted noncommercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ORCID iDs

Jung-Joon Cha   
<https://orcid.org/0000-0002-8299-1877>  
Soon Jun Hong   
<https://orcid.org/0000-0003-4832-6678>

### Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

### Conflict of Interest

The authors have no financial conflicts of interest.

► See the article “Discordance Between Angiographic Assessment and Fractional Flow Reserve or Intravascular Ultrasound in Intermediate Coronary Lesions: A Post-hoc Analysis of the FLAVOUR Trial” in volume 54 on page 485.

In modern clinical settings, interventional cardiologists use both fractional flow reserve (FFR) and intravascular ultrasonography (IVUS) to guide percutaneous coronary intervention (PCI) for cases of intermediate coronary stenosis, which is when the coronary artery lumen is narrowed by 40% to 70%. However, recent data indicate that FFR and IVUS are utilized in only 18.5% and 13.9% of procedures respectively.<sup>1)2)</sup> Despite the proven effectiveness of FFR and IVUS, quantitative coronary angiography (QCA) remains the predominant method for guiding PCI in patients with coronary artery disease. Limitations of QCA include the potential for over- or underestimation of stenosis severity and variability in assessments between different observers, particularly in cases of intermediate coronary lesions.<sup>3)</sup>

Various studies have confirmed that FFR and IVUS-guided PCI provide superior clinical outcomes compared to angiographic-guided PCI. The use of FFR to guide PCI decisions has been shown to decrease the frequency of urgent revascularizations in patients treated with drug-eluting stents compared to medical therapy alone.<sup>4)</sup> IVUS plays a significant role in enhancing stent implantation, which has been linked to reduced mortality and fewer instances of target-vessel revascularization.<sup>5)</sup> The proposed mechanism by which intracoronary imaging leads to improved outcomes involves providing precise vessel size measurements, enabling better stent expansion and contact with the vessel wall, as well as identifying potential complications like dissections; this contributes to a reduced risk of lesion recurrence or restenosis.<sup>6)</sup> Moreover, a study reported that IVUS has shown that more than one-third of patients (39%) fail to meet IVUS optimization criteria even when angiographic criteria are met, leading to poorer clinical outcomes.<sup>7)</sup> Therefore, the discrepancy between angiographic assessment by QCA-derived diameter stenosis and assessments using FFR or IVUS in intermediate coronary lesions can become a significant topic of discussion.

In this issue of the Journal, Lee and colleagues<sup>8)</sup> report the discrepancies between QCA and FFR or IVUS in evaluating intermediate coronary lesions. The post hoc analysis of FLAVOUR trial reveals that approximately 28.2% of intermediate lesions show discordance between QCA and FFR, while 32.4% show discordance between QCA and IVUS. These findings emphasize the necessity of advanced assessments to enhance diagnostic precision and patient outcomes,

**Data Sharing Statement**

The data required to reproduce these findings cannot be shared as this is an editorial.

**Author Contributions**

Conceptualization: Hong SJ; Formal analysis: Cha JJ; Investigation: Cha JJ; Methodology: Cha JJ; Supervision: Hong SJ; Validation: Hong SJ; Writing - original draft: Cha JJ, Hong SJ; Writing - review & editing: Cha JJ, Hong SJ.

The contents of the report are the author's own views and do not necessarily reflect the views of the *Korean Circulation Journal*.

not based on QCA only. Importantly, the present study showed that 2-year clinical outcomes indicate that FFR- or IVUS-guided strategies yield comparable results in managing discordant lesions. For instance, lesions significant by QCA but negative by FFR or IVUS saw deferred PCI without compromising patient outcomes, advocating for a conservative approach in such scenarios. The authors have defined this situation as a mismatch.

In cases of mismatch, the FFR negative group showed a primary endpoint rate of 5.9% at 2 years, while the IVUS negative group showed a lower rate of 3.4%; though not statistically significant, this indicates a trend toward better outcomes with IVUS. The recent PREVENT study compared optimal medical treatment alone versus preemptive stenting with optimal medical treatment in lesions found negative by FFR, reporting a risk reduction of 31% with rates of 5.2% and 3.0%, respectively.<sup>9)</sup> This suggests the inherent limitation of FFR in not being able to reveal lesion characteristics. In context, the present study showed that both the mismatch group and the reverse mismatch group had numerically lower event incidences in the IVUS groups compared to the FFR groups, indicating the need for further research to explore the correlation between plaque vulnerability and subsequent acute coronary events.<sup>10)</sup>

Despite these considerations, the present study can provide a useful option for institutions unable to perform both FFR and IVUS. By implementing either FFR or IVUS, the potential discordance arising from decisions based solely on QCA can be mitigated, ultimately expected to improve patient clinical outcomes.

**REFERENCES**

1. Hannan EL, Zhong Y, Reddy P, et al. Percutaneous coronary intervention with and without intravascular ultrasound for patients with complex lesions: utilization, mortality, and target vessel revascularization. *Circ Cardiovasc Interv* 2022;15:e011687. [PUBMED](#) | [CROSSREF](#)
2. Parikh RV, Liu G, Plomondon ME, et al. Utilization and outcomes of measuring fractional flow reserve in patients with stable ischemic heart disease. *J Am Coll Cardiol* 2020;75:409-19. [PUBMED](#) | [CROSSREF](#)
3. Ahn SG, Lee SJ. Dose coronary angiography suffice for assessment of intermediate coronary stenosis? *Korean Circ J* 2019;49:1033-4. [PUBMED](#) | [CROSSREF](#)
4. De Bruyne B, Fearon WF, Pijls NH, et al. Fractional flow reserve-guided PCI for stable coronary artery disease. *N Engl J Med* 2014;371:1208-17. [PUBMED](#) | [CROSSREF](#)
5. Elgendy IY, Mahmoud AN, Elgendy AY, Bavry AA. Outcomes with intravascular ultrasound-guided stent implantation: a meta-analysis of randomized trials in the era of drug-eluting stents. *Circ Cardiovasc Interv* 2016;9:e003700. [PUBMED](#) | [CROSSREF](#)
6. Shlofmitz E, Iantorno M, Waksman R. Restenosis of drug-eluting stents: a new classification system based on disease mechanism to guide treatment and state-of-the-art review. *Circ Cardiovasc Interv* 2019;12:e007023. [PUBMED](#) | [CROSSREF](#)
7. Cha JJ, Kim D, Kim BK, et al. Association between angiographic and intravascular ultrasound optimizations after new-generation drug-eluting stent implantation and clinical outcomes. *Coron Artery Dis* 2021;32:541-8. [PUBMED](#) | [CROSSREF](#)
8. Lee JH, Ahn SG, Jeon HS, et al. Discordance between angiographic assessment and fractional flow reserve or intravascular ultrasound in intermediate coronary lesions: a post-hoc analysis of the FLAVOUR trial. *Korean Circ J* 2024;54:485-96. [CROSSREF](#)
9. Park SJ, Ahn JM, Kang DY, et al. Preventive percutaneous coronary intervention versus optimal medical therapy alone for the treatment of vulnerable atherosclerotic coronary plaques (PREVENT): a multicentre, open-label, randomised controlled trial. *Lancet* 2024;403:1753-65. [PUBMED](#) | [CROSSREF](#)
10. Yang S, Koo BK. Coronary physiology-based approaches for plaque vulnerability: implications for risk prediction and treatment strategies. *Korean Circ J* 2023;53:581-93. [PUBMED](#) | [CROSSREF](#)