

## Intracoronary imaging: for one or for all?



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Cardiology has no shortage of risk scores. Most confirm what clinicians already suspect, few alter practice, and many are quietly forgotten. For a score to be useful, it should not merely predict what will happen but also help us decide what to do.

In this issue of AsiaIntervention, Kim and colleagues add another layer of risk stratification in a *post hoc* analysis of RENOVATE-COMPLEX-PCI, using a risk score to stratify.<sup>1</sup> The authors ask whether the benefit of intracoronary imaging with optical coherence tomography (OCT) or intravascular ultrasound (IVUS) varies according to percutaneous coronary intervention (PCI) procedural complexity. The results appear persuasive. Target vessel failure with imaging versus angiography was 4.5% versus 5.6% in the low-complexity group, 5.4% versus 13.1% in the moderate-complexity group, and 8.2% versus 12.4% in the high-complexity group, respectively, with an interaction p-value of 0.009. On its surface, imaging benefited the moderate- and high-complexity groups but not the low-complexity group. Simple? Not so simple.

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The first problem is conceptual. The framework used here is not a dedicated score for PCI complexity. Its criteria were drawn from the 2023 European Society of Cardiology acute coronary syndrome guidelines, where residual thrombotic risk is described and may inform decisions about prolonged antithrombotic therapy.<sup>2,3</sup> The guidelines were neither designed nor validated to grade PCI complexity or decide who should be imaged.

The factors are unsurprising. Diabetes, renal disease, previous infarction, and peripheral vascular disease are

combined with left main PCI, chronic total occlusion, bifurcation stenting, lesion number, stent number, and total stent length. Few would see this as anything but obvious. Patients with greater clinical vulnerability who undergo more complex procedures will have more events. The framework may therefore inform prognosis, but can it help select patients for intracoronary imaging?

This distinction matters because the mechanisms are different. OCT and IVUS can improve lesion assessment, vessel sizing, landing zone selection, stent expansion, and the recognition of complications. They cannot remove the systemic risk conferred by diabetes, renal dysfunction, or peripheral vascular disease. Several procedural factors, including the number and total length of stents, also become apparent only during the procedure and may themselves be changed by imaging. A risk score that is comprised in part after the treatment decision cannot credibly determine whether imaging should have been used in the first place.

The label “low risk” (of complexity) is therefore particularly liable to misinterpretation. Every patient in RENOVATE-COMPLEX-PCI had complex coronary anatomy. These were not straightforward lesions in patients undergoing routine PCI. They were the lower-risk members of an already complex population. The analysis does not inform whether imaging is beneficial in non-complex PCI nor does it establish that imaging can safely be omitted even in its own low-risk subgroup of complex lesions.

The point estimate favoured imaging in all three groups, but the low-risk comparison contained only 18 target vessel failure events and had little power to demonstrate a modest treatment effect. As baseline risk falls, the absolute benefit of

imaging may become smaller, which means that substantially more patients are required to establish it statistically. The absence of a nominally significant result is not evidence that a benefit is absent. It may simply be harder to detect. Among low-complexity patients, the adjusted hazard ratio for benefit with imaging was 0.735, consistent with a 26% relative risk reduction, although the wide confidence interval precluded this difference reaching statistical significance. This finding is thus most appropriately termed “inconclusive” rather than “negative”.

There is another reason to resist a threshold interpretation. The observed benefit was not progressive across the three categories. Absolute risk reductions were 1.1%, 7.7%, and 4.2% in the low-, moderate- and high-complexity groups, while the adjusted hazard ratios were 0.735, 0.374, and 0.633, respectively. By either measure, the largest apparent benefit occurred in the middle rather than in the highest-complexity group. The significant interaction indicates heterogeneity among the estimates, but it does not establish a biological dose response or prove that imaging begins to work at a particular threshold. Given the small number of events and wide confidence intervals, random variation is at least as plausible as a true concentration of benefit in the intermediate-risk group.

A previous analysis from the same trial, supplemented by a registry because of limited power, assessed complex lesion features in 4,611 patients.<sup>4</sup> Imaging reduced target vessel failure across the spectrum, while its absolute benefit generally became larger as complexity accumulated. We argued then, as we do now, that imaging is a strategy of procedural precision whose benefit becomes easier to demonstrate and more efficient to harness as risk rises. It is not a therapy that abruptly starts working once a threshold is crossed.<sup>5</sup> The present analysis changes the classification, but not the principle.

The totality of randomised evidence supports fewer target lesion- and stent-related events with OCT- or IVUS-guided PCI.<sup>6-8</sup> In RENOVATE-COMPLEX-PCI, that advantage has persisted beyond five years.<sup>9</sup> The clinical conclusion should therefore be straightforward. Once PCI is complex, intracoronary imaging should be the default rather than a privilege reserved for patients who satisfy a *post hoc* risk category. Baseline lesion complexity will influence the absolute benefit, number needed to treat, and cost-effectiveness, but it is unlikely to affect the relative benefit of imaging guidance.

Kim and colleagues deserve praise for addressing an important implementation question and for demonstrating that clinical vulnerability and procedural burden identify patients with a greater event rate. Their analysis may help estimate the absolute return from imaging and could inform future cost-effectiveness or implementation studies. It should not, however, be used to ration OCT or IVUS. Before such a framework can guide treatment, it would require prospective validation, variables available before the imaging decision, and convincing evidence that patients classified as low risk would derive no clinically relevant benefit. Until then, the more coherent interpretation is that intracoronary imaging improves the precision of complex PCI and clinical

outcomes across the spectrum of risk, while increasing lesion complexity makes the consequences of proceeding without imaging guidance more readily apparent.

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## Conflict of interest statement

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