

From Protocol to Precision: Optimizing IVI Workflows in the Cardiac Cath Lab

Although most cath labs have the tools and clinical evidence to support intravascular imaging–guided PCI, underuse points to an operational, rather than clinical, barrier.

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When interventional cardiologists use intravascular imaging (IVI) to guide percutaneous coronary intervention (PCI), patients have better outcomes, with fewer heart attacks and repeat procedures and lower mortality rates. These findings are well established through robust data, including a 2024 analysis of 20 randomized trials.¹

Among Medicare patients who had PCI with imaging guidance, researchers found lower rates of 1-year death, heart attack, repeat procedures, and major cardiac events compared to patients who underwent PCI guided by angiography alone.²

In 2025, the American College of Cardiology (ACC), American Heart Association, Society for Cardiovascular Angiography and Interventions published updated guidelines, giving IVI a class I recommendation for complex PCI, defined as left main disease, bifurcation lesions, long lesions (> 28 mm), in-stent restenosis, heavily calcified vessels, small vessels, and acute coronary syndrome presentations.³ The European Society of Cardiology guidelines made the same designation in 2024.⁴

It's important to be precise about the evidence, as the two modalities are not identical in their guideline standing. Intravascular ultrasound (IVUS) carries the stronger randomized trial evidence base, supported by decades of data across diverse patient populations. Optical coherence tomography (OCT) has a growing body of evidence and earns a class IIa recommendation, with class I status in specific contexts.^{5,6} Both are far better than angiography alone for complex cases. The distinction matters when building a protocol because it should inform your lab's default modality selection.

Build the protocol. Post the numbers. Train people to read the images, not just run the catheter. The tools are already in the room.

BRIDGING THE GAP BETWEEN EVIDENCE AND PRACTICE

More than 85% of United States hospitals performing PCI have the equipment to perform IVI. Yet, even using 2020 as a baseline, before the most recent guideline upgrades, the median utilization rate across those hospitals was just 6.3%.⁷ More recent Medicare data show that IVI was used in only 10.5% of all PCI procedures, with a median operator use rate of 3.92%.² Although the trend is moving in the right direction, there is still a significant gap between where we are and where the evidence says we should be.

In one of the largest analyses of IVI use variability to date conducted across the Veterans Affairs (VA) health care system, the biggest driver of whether a patient received imaging-guided PCI was not severity of sickness or lesion complexity. Notably, hospital-level factors accounted for 54% of the variability in IVI usage; physician-level factors accounted for 33%, and patient and lesion characteristics—what should drive the decision—accounted for just 1.1%.⁸

Although the VA population has specific characteristics that may not generalize to every practice setting, the directional finding is consistent with what many cath lab leaders already know anecdotally: whether a patient gets imaging-guided PCI is heavily influenced by institutional culture and physician habit rather than clinical need alone.

TABLE 1. WHICH MODALITY AND WHEN: A PRACTICAL REFERENCE FOR CATH LAB TEAMS

Feature	IVUS	OCT
How deep it sees	4-8 mm deep; sees the full vessel wall	1-3 mm deep; ultra-sharp surface detail
Image sharpness	Good, works well for most stent decisions	10 times sharper than IVUS, best for fine detail
Need to flush blood?	No	Yes—requires contrast flush; use carefully with kidney disease
Best used for	Vessel sizing, left main disease, calcium, stent expansion	Stent apposition, edge tears, restenosis causes, plaque type
2025 guideline rating	Class I (ACC/AHA/SCAI 2025 ACS ³ ; ESC 2024 CCS ⁴); strongest randomized trial evidence base of the two modalities	Class IIa (ACC/AHA/SCAI 2025); strong recommendation with growing evidence ³ ; class I for specific contexts per ESC 2024 ⁴
Workflow tip	Preconnect to console for every PCI case; use automated pullback at 0.5 mm/s for consistent measurements	Use the MLD MAX checklist (morphology, length, diameter, medial dissection, apposition, expansion) → cuts variability

Abbreviations: ACC, American College of Cardiology; ACS, acute coronary syndrome; AHA, American Heart Association; CCS, chronic coronary syndrome; ESC, European Society of Cardiology; IVUS, intravascular ultrasound; OCT, optical coherence tomography; PCI, percutaneous coronary intervention; SCAI, Society for Cardiovascular Angiography & Interventions.

The barriers that repeatedly arise are familiar: “it slows down the case,” “I can see enough on angio,” “I’m not comfortable interpreting it.”^{9,10} These are all operational and cultural arguments, not clinical arguments. Setup is slow because it’s not built into the workflow. Interpretation is uncomfortable because it’s not being adequately taught. Angiography “feels” sufficient because no one is showing operators what they’re missing. One interventional cardiologist said it plainly at Transcatheter Cardiovascular Therapeutics 2025: “Less than one-third of procedures are being done with these imaging modalities. ... If you are not using an IVI modality, the PCI is not optimal.”⁸

This is not the first time the cath lab needed to close the gap between what the evidence says and what happens in practice.

Door-to-balloon time for ST-segment elevation myocardial infarction was all over the map until hospitals developed systems, including clear triggers, standardized workflows, and performance tracking.⁷ Radial access for PCI followed the same arc: once viewed as too technically demanding for broad adoption, it scaled rapidly once training became systematic and outcomes were tracked at the program level. IVI adoption will follow the same path when it gets the same infrastructure.

Table 1 provides a practical reference for modality selection—a necessary first step because IVUS and OCT serve overlapping but distinct clinical purposes.^{3,4} Establishing a lab-level default with clear criteria for switching reduces the cognitive load of in-the-moment decision-making and creates a consistent baseline for performance tracking.

Once modality selection is established, the greatest impact then lies in physical workflow. The LightLab

Initiative is a structured quality improvement program supported by Abbott and designed to evaluate the use of a standardized step-by-step OCT protocol to guide treatment decisions during PCI. In the study, standardized use of MLD MAX (morphology, length, diameter, medial dissection, apposition, and expansion) improved procedural efficiency and reduced interoperator variability without adding procedure time.¹¹ This is consistent with what’s seen in implementation science—structured checklists reduce variability regardless of the domain.

ELEMENTS OF A STANDARDIZED PROTOCOL

Table 2 lays out six key steps for standardization of IVI.^{2,12} While not complicated, they do require leadership investment and decision-making.

Importantly, tracking matters more than programs often realize. A 2025 study by Stein et al showed that IVI utilization rate meets the National Quality Forum’s standards of a formal performance measure at both the hospital and physician level.⁸ The necessary data are already captured in procedural documentation and can be extracted and shared.

Programs also often underinvest in training. The ACC recommends a minimum of 25 supervised IVI cases,⁷ but volume alone is not the solution if the operator can’t interpret the image. Image interpretation needs to be part of onboarding, credentialing review, and ongoing education, not just catheter setup.

THE ECONOMIC CASE FOR IVI ADOPTION

The concern that IVI adds catheter expense and procedure time is not supported at the program level;

TABLE 2. KEY ELEMENTS FOR CATH LAB STANDARDIZATION OF IVI

What to Standardize	Practical Application
When to use imaging	Write it down. Always image left main, complex lesions, long stents (> 28 mm), ACS, in-stent restenosis, and heavy calcium. For gray areas, document the choice.
Which modality to use	Pick a default (IVUS or OCT) for your lab based on your patient population and evidence base, and define the criteria for switching. Moving from case-by-case preference to a written protocol is one of the highest-leverage administrative changes most labs can make.
Room setup	Preconnect the imaging catheter before the case starts, not after you decide to use it.
How to pull back	Use automated pullback every time you need a measurement. Write the speed in the procedure note (0.5 mm/s for IVUS, 25 mm/s for OCT). Manual pullback should be the exception rather than the norm when measurements matter.
Track your numbers	Track IVI rates by operator and case complexity on a quarterly basis. Data should be compared to the national average (10.5%) ² and shared transparently. Performance data influences practice patterns.
Train on interpretation	The minimum 25 supervised cases per ACC guidelines is only a baseline. ¹² Operators who are unable to accurately interpret IVI are unlikely to modify their behavior based on these findings, underscoring the importance of dedicated training in image interpretation.

Abbreviations: ACC, American College of Cardiology; ACS, acute coronary syndrome; IVI, intravascular imaging; IVUS, intravascular ultrasound; OCT, optical coherence tomography.

overall financial impact trends in the opposite direction. A target vessel failure requiring repeat revascularization can cost tens of thousands of dollars per episode in downstream care. An unplanned readmission for stent thrombosis or myocardial infarction is even more expensive. IVI-guided PCI has been consistently associated with lower rates of both cost and procedure time.

Long-term data from the Premier healthcare database showed that IVUS use was tied to lower mortality at both 1 and 10 years.¹³ This is a strong value argument for any health system operating under value-based contracts or bundled payments. Reimbursement for IVI during PCI is established via CPT codes, and in most programs operating under typical United States fee-for-service arrangements, current rates are sufficient to cover adoption without running a loss. The real investment will be not equipment but rather training and workflow redesign—a one-time effort with durable return.

CONCLUSION

The evidence and guideline gaps have been addressed; the remaining challenge is operational. When the biggest predictor of whether a patient gets IVI-guided PCI is which hospital they go to rather than how complex their disease is, that is a fixable system problem. However, it will take leaders who are willing to build the infrastructure, measure the outcomes, and hold people to a standard. ■

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