

Optimal Angiography Post PCI: Should the Guidewire Stay In or Out? Do Small Changes in Cath Lab Techniques Matter?

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Interventional cardiology is among the most dynamic fields in medicine. Over the 3 decades since its introduction, many of our senior interventionists and staff have seen a huge number of new and innovative techniques requiring modification or major change in the way we do the business of catheterization, angiography, percutaneous coronary intervention (PCI), hemodynamics and other procedures, always replacing older methods once thought to be immutable standards.

Dr. Seto and I were reflecting on the changes that have occurred just over 2 last decades in our laboratory (see Table), most notable of which included radial access, intravascular lithotripsy, and transcatheter aortic valve replacement. An innocuous question was raised at a Transcatheter Cardiovascular Therapeutics (TCT) investigators' meeting involving fractional flow reserve (FFR) angio (FFR derived from the coronary angiogram). The FFRangio requires optimal angiography of

the coronary tree in at least 3 angulations without panning. To many, this was a change in their angiographic technique. Moreover, one of the investigators asked, "What constitutes optimal angiography after PCI?" Although it seemed a no-brainer to me (but as with many things, some turn out to be 'brainers', ie, something important to ponder), I wanted to get a broader take on angiography in 2023. Here was a specific angiographic question: "Should final angiography always be done with the guide wire in or out of the artery?" A minor point, but it certainly generated controversy.

Some investigators said leave the wire, as it helps keep a precarious guide position stable. However, others noted that the guidewire in the artery may obscure luminal details such as edge dissection, thrombus, or other intraluminal material on the final images around the lesion and stented segment. Others said leaving the wire might also cause the automatic artery tracking used for the angiographic



Figure 2. Our RT, "NO-PAN" Dan (at left) with Dr. Kern (see Table).

artery tree reconstruction to deviate from the correct path. Still other operators said that if you finish with intravascular ultrasound (IVUS)/optical coherence tomography (OCT), you always see the problem and thus the presence of the wire makes no difference. My response to this question was that I routinely tell fellows at the end of the case to remove the wire to see the artery better, especially for spots that may have a problem (eg, small dissection). There is no downside, except for the situation with a difficult guide. I am still not certain that a final IVUS/OCT run guarantees a good angiographic result for FFRangio. We are still talking about it.

Lastly, for the best FFRangio, and perhaps all angiography, a large image field (10 inches) without panning is required. This field size and no panning are a change in technique from our normal habit. While working to routinely incorporate the larger field size without panning into our daily technique, our radiologic technologist, Dan, became adept at reminding us of these requirements and received the honorific title of "NO-PAN" Dan. I asked a couple of my cath lab experts, "What do you teach your fellows about their angiographic technique?"

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— Morton J. Kern, MD



Figure 1. "New Dog" (see Table): Cath lab team without lead aprons behind the Protego system (Image Diagnostics).

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— Jim Blankenship, MD, MHCM, MSCAI



Bonnie Weiner, Worcester, Massachusetts: [I recommend taking the] wire out unless there is a compelling (unusual) reason to leave it. We need to focus on the lesion, but make sure you haven't missed something distally like a wire perforation. It doesn't matter if you have done IVUS/OCT. Not everyone will be able to see those images if the patient comes back,

TABLE 1. Old Tricks - New Dogs.

Technique	Old Trick	New Dog	Comment
Minimal angiographic views after PCI	2+ mandatory views	One good view with intravascular imaging	<i>2 views still make sense</i>
Guidewire in for final views	No	Yes	<i>IVUS/OCT may or may not detect small problems</i>
Panning	Necessary when using small image field for best resolution	No panning when using larger field. Images have improved	<i>No panning is necessary for QCA used FFRangio</i>
Frame rate	15 frames per second (fps)	7.5 fps	<i>Less is more</i>
Magnification	8-inch	10-inch	<i>Less radiation</i>
Image storage	Cine all steps	Fluoro-save	<i>Less radiation</i>
Radiation protection	0.5mm heavy lead	No lead aprons – use Protego (Image Diagnostics), Rampart	<i>Radiation protection with less back pain*</i>
More support	Buddy wire	Guide extension	<i>Improved guide extensions coming</i>
Calcium	Atherectomy, cutting balloons	Intravascular lithotripsy, atherectomy, laser	<i>Better intravascular imaging for calcium helps</i>
Renal function and contrast volume	Amount impacting renal function thought to be less important than good imaging	Use as little as possible to obtain excellent angiograms	<i>Average contrast volume for angio study now half of that from 10 years ago</i>
Vascular access	Femoral > radial	Radial > femoral	<i>For almost all diagnostics but femoral for large-bore procedures</i>
Femoral access closure	Manual, collagen-based closure devices, suture closure devices	Combination devices, figure 8 stitch	<i>Improved Perclose (Abbott) and large-bore access closure device</i>
Radial access closure	Radial compression band	Hemostatic patches, numerous pressure bands	<i>Many choices now</i>
Chronic total occlusions	Avoid PCI – success rates <60% in some	Consider for PCI – experts have >90% success	<i>Treat them (almost) like 99% stenoses. Specialized wires, microcatheters, etc.</i>
Observation time	Overnight for all PCI	Same-day discharge	<i>Safe, efficient, and patient-centered, especially with radial access</i>
Cardiac surgery backup	Required for most PCI	Rarely required, PCI in noncardiac surgery facilities including ASCs	<i>Safe and efficient</i>
Support devices	IABP only	IABP, IMP, TH, ECMO	<i>Many choices now</i>
Intravascular imaging	IVUS	OCT, HD-IVUS, NIRS, combination devices	<i>Clinical data supportive of routine use</i>
Coronary hemodynamics	FFR only. Doppler wire for CFR disappeared.	iFR, RFR, dPR Angiographic FFR CT-FFR, Thermodilution CFR	<i>Many choices now</i>

***See Figures 1-2.**

PCI = percutaneous coronary intervention; IVUS = intravascular ultrasound; OCT = optical coherence tomography; QCA = quantitative coronary analysis; FFR = fractional flow reserve; ASC = ambulatory surgical center; IABP = intra-aortic balloon pump; IMP = xx; TH = xx; ECMO = extracorporeal membrane oxygenation; HD = high definition; NIRS = near infrared spectroscopy; CFR = coronary flow reserve; iFR = instantaneous wave-free ratio; RFR = resting full-cycle ratio; dPR = diastolic pressure ratio; CT = computed tomography

but should be able to see the angiograms. It's important that any abnormalities be clearly documented in the report.



Jim Blankenship, Albuquerque, New Mexico: Peter Berger [famous cardiologist] always tried to convince me that 2 orthogonal cine runs with the wire out were necessary. I was satisfied with one. We did agree that

final angiography with the wire out was more important in the prehistoric days of balloon angioplasty, when, rarely, a wire might be propping open a coronary dissection. In the current era, sometimes it is useful to remove the wire in order to see details of the coronary anatomy. As noted, though, removing the wire sometimes allows the guide to dislodge. It can really be annoying to have to maneuver the guide back into the coronary at the end of a long case. My approach is after taking the best possible images with the wire in place, do a final angiogram while pulling the wire out so that one can see the artery at the end of the injection without the wire. Even if the guide dislodges due to removing the guide, one can almost always get enough dye down the artery before it dislodges to see it clearly.



William Fearon, Palo Alto, California: Unless issues with kidney function, finish with 2 orthogonal views and at least one with the wire out.



Bonnie Weiner, Worcester, Massachusetts: Preferably both with the wire out. If folks are so concerned about the guide catheter engagement, maybe it was not the right choice to begin with?

[MK: yes, but that's after the fact and at the end of the case.]

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Disclosures: Dr. Morton Kern reports he is a consultant for Abiomed, Abbott Vascular, Philips Volcano, ACIST Medical, and Opsens Inc.

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Matheen A. Khuddus, Gainesville, Florida: When I completed my interventional cardiology training 15 years ago, performing a final angiogram with the wire out and in 2 views was an important final step. It was

performed to ensure that there was no vessel dissection or distal perforation that was unrecognized with the wire in place. I faithfully adhered to this and considered it to be the sign of a well-trained and thoughtful interventional cardiologist.

In the 15 years since then, my practice (like so many others) has changed considerably and now includes the use of routine radial access and intracoronary imaging. Both were rarely used when I trained. With routine post-PCI imaging use, unrecognized vessel dissection is no longer a concern that would necessitate final "wire out angiography". In many cases, particularly with OCT using contrast, the final run may also be adequate to exclude a distal wire perforation. In the cases where it is not, pulling the wire back but not out allows guide catheters and guide extension catheters to remain engaged and coaxial to reduce the risk of proximal vessel guide dissections while taking one final picture to rule out distal wire perforation.

I still do perform "wire out" angiography when I feel it is indicated, but it is no longer the mandatory completion step it once was for me. The omission of this step is not a cavalier decision, but rather a carefully considered and thoughtful one.

Bottom Line

The evolution to better techniques in the cath lab has been and will continue to be a continuous and stimulating process. We should always keep an open mind to doing things if they are part of a better way. We should also recognize that change can be painful, but best practices and patient care should ease this discomfort. Just remember what it felt like when you started on the radial access journey. Dr. Seto and I put together a small table of tricks that we thought both old and new dogs can learn. I'm sure you could add to this list. Enjoy the trip down memory lane. ■



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