

Stenting Across Coronary Aneurysms – What's the Best Way?

Morton Kern with contributions from Dave Cox, Charlotte, North Carolina; Steve Jenkins, Ochsner Clinic, New Orleans, Louisiana; Dean Kereiakes, Cincinnati, Ohio; Gary Mintz, Cardiovascular Research Foundation, New York City; Jeffrey Moses, St. Francis Hospital, Roslyn, New York; Steve Ramee, Ochsner Clinic, New Orleans, Louisiana; Ken Rosenfield, Boston, Massachusetts; Barry Uretsky, Little Rock, Arkansas.

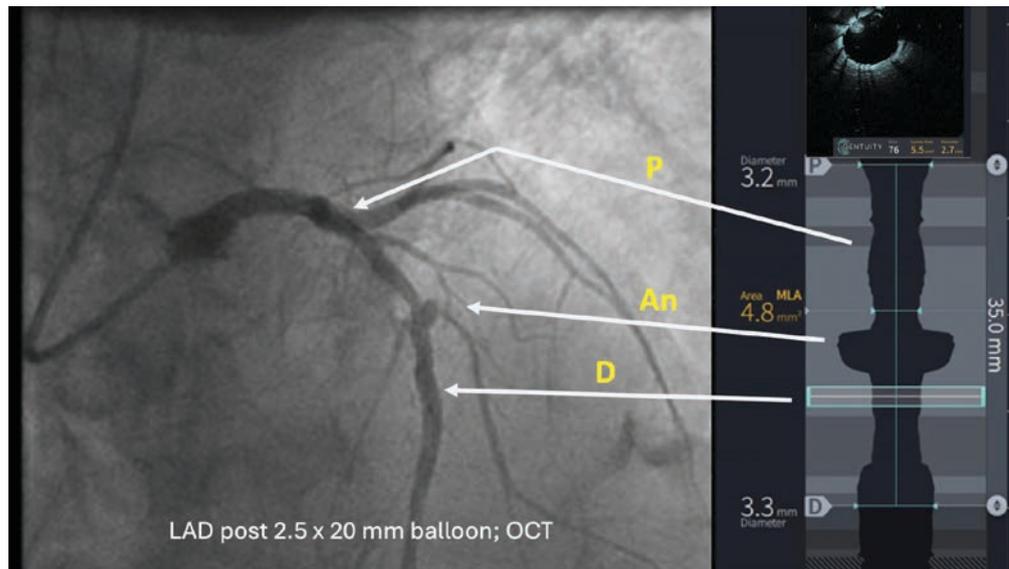


Figure 1. Left, angiogram of left anterior descending (LAD) coronary artery post 2.5 mm x 20 mm balloon for 80% stenosis on each side of large aneurysm. Right, reconstructed screen shots from Gentyu optical coherence tomography (OCT) image from distal (D) to proximal (P). An = aneurysmal segment. Blue rectangle on pullback screen shows location of OCT frame.

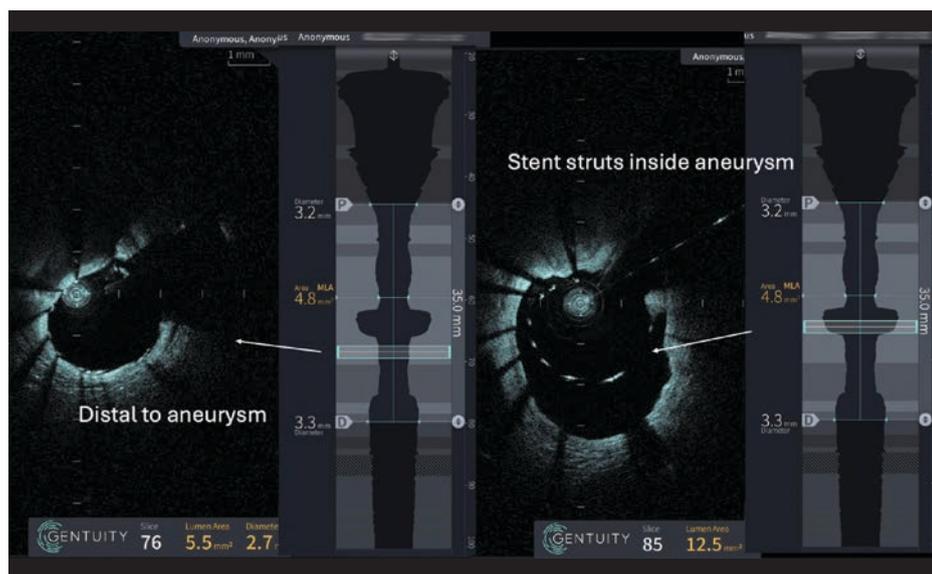


Figure 2. OCT images with longitudinal pullback locations. Left, OCT frame distal to aneurysm. Full strut apposition is noted with 2.7 mm diameter. Right, 3.0 mm x 32 mm stent struts floating in middle of aneurysm, which is 4.8 mm in diameter.

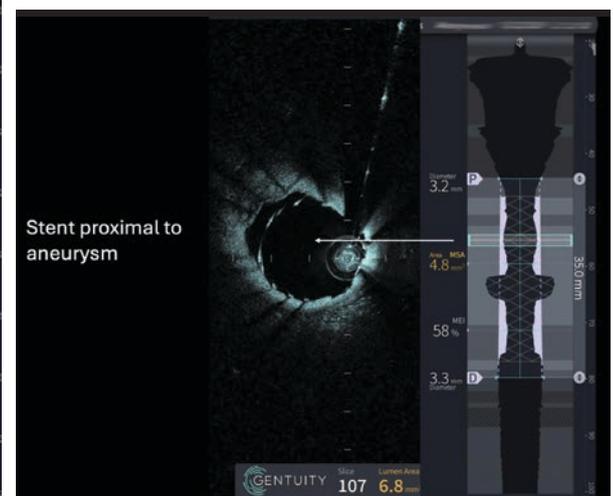


Figure 3. OCT frame and pullback showing stent apposition proximal to the aneurysm. The 3.0 mm x 32 mm stent struts show incomplete apposition from 9 o'clock to 12 o'clock.

Stenting across a coronary aneurysm invariably leaves free-floating struts which remain of concern to the operators despite good antiplatelet regimens after the procedure. Most of the time, this is a benign percutaneous coronary intervention (PCI) event. Historically, the stented aneurysms are rarely associated with vessel thrombosis, but promote some change in the rheology within the aneurysm to promote aneurysmal clotting without affecting lumen flow. We recently treated a patient with a coronary aneurysm. After completing the procedure, I was interested in my colleagues' views to see if I had missed something.

Case and Query



Mort Kern, Long Beach, California: Colleagues, I think I missed the boat on getting an optimal result for a 75-year-old male with a non-ST-elevation myocardial infarction (NSTEMI), high blood pressure and cholesterol, and ETOH abuse. The electrocardiogram showed anterior T wave changes. Elevated troponins (about 2000u) were reported. There was heavy calcification of the right coronary artery (RCA) with only mild disease. The circumflex artery (CFX) had irregularities but no lesions. The left anterior descending (LAD) was also calcified with an 80%-90% stenosis on each side of a large coronary

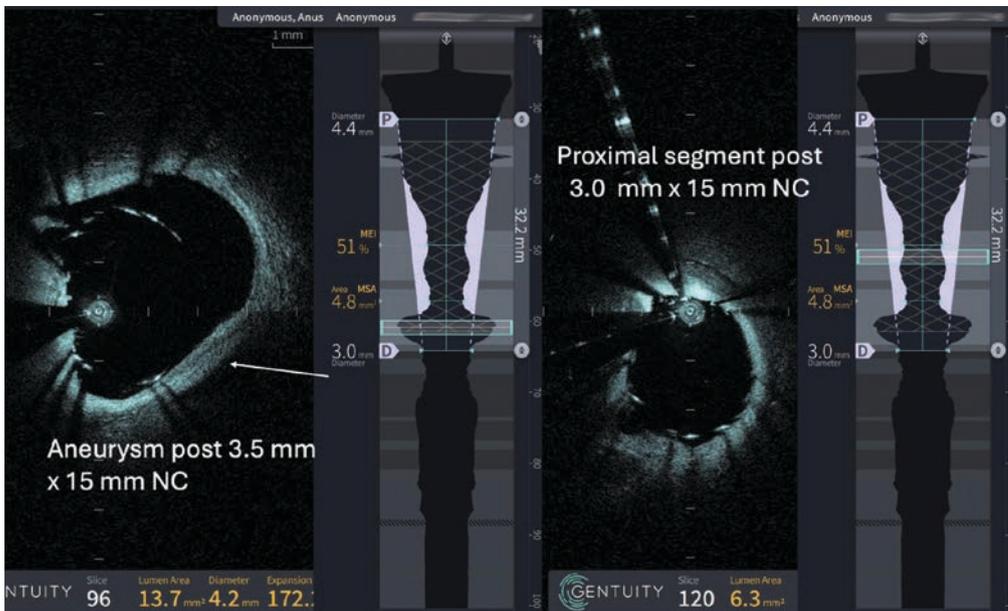


Figure 4. OCT images after 3.5 mm x 20 mm noncompliant (NC) balloon. Left, stent struts inside aneurysm still floating. Right, proximal stent struts are still partially unopposed.

aneurysm about 6 mm in diameter. The PCI was begun with a 2.5 mm x 20 mm balloon, followed by optical coherence tomography (OCT) imaging (Figure 1), then a 3.0 mm x 32 mm drug-eluting stent (DES). OCT showed the free-floating struts and malapposed struts in the proximal segment (Figures 2-3). A 3.5 mm x 15 mm noncompliant balloon just proximal to the stent was used to optimize stent expansion but not applied to the very proximal stent for fear of dissecting the calcific proximal region. Final OCT showed some further stent apposition (Figure 4).

I was concerned about the floating struts and the patient's poor reliability regarding P2Y12 inhibitors. What's your approach to stenting across the coronary aneurysm? Larger balloon? Covered stent? Coronary artery bypass graft (CABG) surgery? Let me know what you think. You can also tell me if this is the first step to full retirement from the lab, but I am not quite ready yet (but close).



Dave Cox, Charlotte, North Carolina: I'm assuming the poor reliability for P2Y12 compliance isn't relevant. If that truly was the case, you would have done a left internal mammary artery (LIMA) bypass and whether struts float in

an aneurysm versus full stent apposition doesn't matter if you don't take dual antiplatelet therapy (DAPT).

Early in the history of stenting, Paul Teirstein saw that stenting across an aneurysm with attendant inability to fully appose struts had no impact on stent thrombosis or restenosis. Like everything Paul says, that clinical pearl has held up over time.

I do not think you are ready for the pasture of retirement yet based on this case. I've seen too many perforations when a well-meaning operator driven by intravascular ultrasound (IVUS) or OCT attempted to size a stent to the aneurysm and resulted in a massive tear in the vessel. I do not think a prophylactic covered stent with its attendant higher restenosis and thrombosis rate to avoid any perforation from such a misguided pathway makes sense.



Steve Jenkins, Ochsner Clinic, New Orleans, Louisiana: The worst thing you could do is deploy a covered stent. Regardless of patient adherence to a P2Y12 antagonist, the aneurysm will thrombose over a month. We commonly do this in the carotid world across the carotid bulb and in the peripheral/coronary artery/graft world, stenting across pseudoaneurysms

using multiple stent platforms with no distal sequela in my 30 years of experience. Flow disruption behind the struts will precipitate thrombosis, and the struts and jailed thrombus will reendothelialize nicely in 2 to 4 weeks. I would recommend scheduling either a follow-up angiogram or computed tomography angiography (CTA) in one month to prove this to yourself. If you do, please share a before and after image with the group. I learned this from Gary Rubin in the early days of carotid stenting placing Palmaz balloon-expandable stents (BES) in the carotid artery in some of the early trials. It has passed the test of time for the last 30 years in every vascular bed in a human and we invade them all at Ochsner!



Jeffrey Moses, St. Francis Hospital, Roslyn, New York: [Stent] Apposition per se is virtually meaningless. It's all about expansion. I might have expanded the entry point to facilitate future access. But apposition in an aneurysm is pointless and dangerous. Agree with Dave.



Ken Rosenfield, Boston, Massachusetts: I agree with Dave, Steve [Jenkins], and Jeff on this one...other than gently expanding the proximal stent a bit more to obtain apposition there, I would

have done the same. Of note, this aneurysm is small enough that I doubt it will ever rupture (unless some operator decides they want to manipulate or over dilate!). Of note, since flow will persist into the diagonal branch that arises off the aneurysm, this may prevent it from "sealing off". But if there were no branch (as Steve suggested), the stent might act like a "flow diverter" (often used by our neurointerventional colleagues in cerebral aneurysms) and this aneurysm would potentially seal itself.

A good question would be, what if the aneurysm were three times the size and therefore more likely to rupture? In that case, one could consider stenting the LAD and coiling the aneurysm (resulting in infarction in the diagonal territory) or sending the patient for CABG.

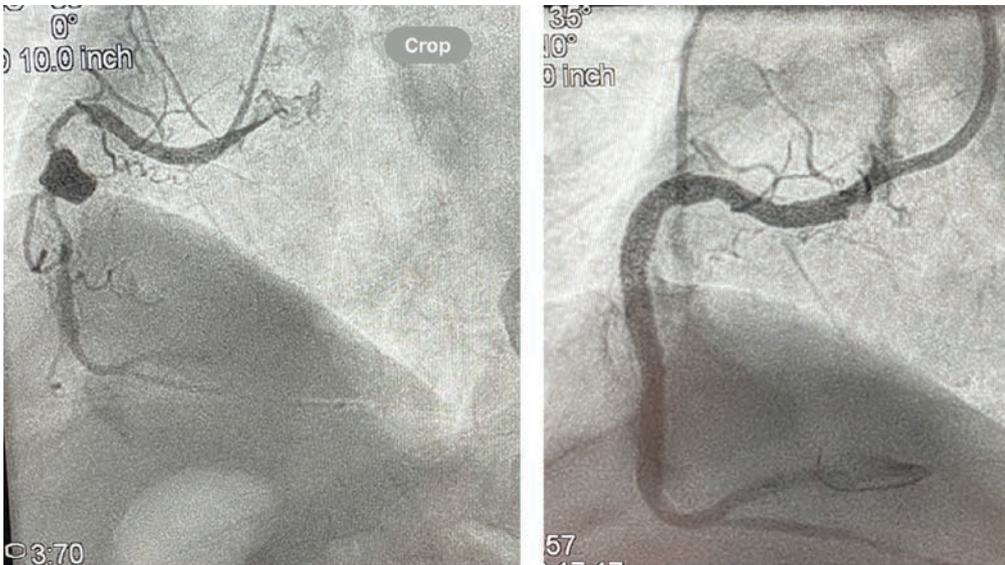


Figure 5. Left, cine frame from patient with large right coronary artery aneurysm in a highly diseased proximal segment. Right panel, right coronary artery (RCA) after serial large, covered stents. *Courtesy Dr. Dean Kereiakes.*



Gary Mintz, Cardiovascular Research Foundation, New York City: I see three issues:

(1) Proximal edge malapposition;

(2) Under expansion in the calcified segment — the minimal lumen area (MLA) is only 4.8 mm² in the proximal LAD;

(3) Malapposition where the stent crosses the aneurysm.

Proximal edge malapposition could be a problem if the patient returns for another procedure — the wire could go behind the stent. Otherwise, it's meaningless.

It is typically impossible to expand a stent to obliterate the malapposition where the stent crosses an aneurysm. More importantly, it is of no consequence. Most of the time, correcting the stenoses proximal and distal to the aneurysm will cause the aneurysm to regress, which is why expansion is important.



Barry Uretsky, Little Rock, Arkansas: One small point — a “true” coronary aneurysm, ie, with all three layers, even if large, is unlikely to rupture. On the other hand, a pseudoaneurysm,

such as occurs after PCI, is more likely to rupture the larger it is.



Dean Kereiakes, Cincinnati, Ohio: For true aneurysms that are large, I favor a Papyrus (BIOTRONIK) as in this case (Figure 5). Followed by Onyx (Medtronic) proximal and distal with Papyrus overlap. Done 5 years ago with long-term good result. I have coiled and stented over a couple of these as well. Can stent first and deliver coil through a micro-catheter through the stent struts/cell.



Steve Ramee, Ochsner Clinic, New Orleans, Louisiana: I have experience with coronary, renal, vascular, and intracranial aneurysms, and I borrow from this experience when I deal with coronary aneurysms. Small aneurysms like this are usually innocent bystanders of coronary artery disease (CAD) and require no treatment. Large aneurysms are more likely to thrombose and embolize than rupture, so DAP is recommended. Multiple, very large aneurysms are best managed with ligation and bypass in patients who are candidates to prevent embolization and infarction.

If I must stent across an aneurysm because of concomitant CAD like you [Mort] did, I choose stent size according to the proximal and distal

vessel diameters as without an aneurysm. I use standard DAP. If treating an isolated coronary aneurysm in a native coronary artery, there are two options: (1) stenting with coil embolization before or after stenting with detachable neuro coils, or (2) covered stent. If coiling is the best option, I will use the help of my neurointerventional colleagues who do this on a regular basis and know the best tools available. If using a covered stent to treat aneurysmal disease or pseudoaneurysm/ruptures, it is optimal to have at least one centimeter of coverage on both sides of the aneurysm to prevent endoleak. This will usually require more than one Papyrus stent in a native coronary artery, and this will occlude branch vessels. In a bypass graft, this will be simpler. In very large bypass grafts, there are self-expanding and balloon expandable covered stents from Gore that can be used.

The Bottom Line



Mort Kern, Long Beach, California: Stenting across moderate single coronary aneurysms seems acceptable and common practice. Gigantic aneurysms, pseudoaneurysms after PCI, and serial large aneurysms should prompt a heart team discussion to consider covered stents or CABG. Continued P2Y12 inhibition for an extended period is still controversial. I hope you'll discuss the management of coronary aneurysms in your lab and see whether the consensus opinion matches ours. ■

Continued P2Y12 inhibition for an extended period is still controversial. I hope you'll discuss the management of coronary aneurysms in your lab and see whether the consensus opinion matches ours. ■

Missed one of Dr. Kern's monthly columns? Visit his page on CLD to read more:



Morton J. Kern, MD, MScAI, FACC, FAHA
Clinical Editor; Interventional Cardiologist, Long Beach VA Medical Center, Long Beach, California; Professor of Medicine, University of California, Irvine Medical Center, Orange, California

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

*Dr. Kern can be contacted at mortonkern2007@gmail.com
On X @MortonKern*