

Chronic Total Occlusion of the Coronary Artery

Announcer: Welcome to the Mayo Clinic cardiovascular continuing medical education podcast. Join us each week to discuss the most pressing topics in cardiology and gain valuable insights that can be directly applied to your practice.

Dr. Bell: Hello, everyone. And welcome again to one of our interviews in our series of interviews with the experts. I'm Malcolm Bell. I'm the Vice Chair of the Department of Cardiovascular Medicine at Mayo Clinic, Rochester here. And I have with me here today, my colleague, Dr. Abhiram Prasad, who's a Professor of Medicine and Interventionalist, who's in the division of Interventional Cardiology here, who's here to talk about PCI of CTOs. So welcome, Abhi.

Dr. Prasad: Hey Malcolm, it's a pleasure to be here and thank you for having me.

Dr. Bell: Yeah. So let's start with really a pretty straightforward question and that is with respect to PCI of CTOs, what sort of patients and maybe what sort of CTOs should we be thinking about performing?

Dr. Prasad: I think that's a very important question, it's a starting point. I think that if we understand what the purpose of intervention will be, would be the best starting point and really unlike other interventions that we do PCIs, CTOs represent a specific group of patients where the risk benefit ratios are quite different and understanding the benefits they can derive are also different. The key patient to choose is one who has severe symptoms, that's not controlled with medical therapy. That's the starting point, because as with PCI and any other stable scenario, really that's what we're trying to do, relief symptoms. We cannot change outcomes in terms of mortality. So a patient who is on multiple medical antianginal therapy agents, who continues to have symptoms and a CTO is really the starting point. And then we have to think about angiographic and other findings that may make them less or more suitable for intervention.

Dr. Bell: So of course that's, we're talking about a patient who has a untreated CTO. But of course if they've had multivessel disease we might often just treat the other vessels rather than the one with the CTO, is that a reasonable strategy, or should we be thinking about treating the CTO upfront with the other lesions?

Dr. Prasad: And that's again, situation we often encounter because single vessel CTOs are not common. Most of the times we see CTOs it's in the context of multivessel disease. And I think it's important to step back and look at the whole picture and decide whether surgery versus percutaneous vaporization is more suitable. That's really in my mind the first question and that depends on complexity of the disease and how suitable the CTOs for percutaneous success. So if you have a patient who has a CTO that seems very likely that will succeed and all the other lesions are very amenable and there's no other reason for CABG, then I think percutaneous is the way to go. Whereas if you have very complex disease and throw in a CTO that would make me think that surgery is preferable.

Dr. Bell: Yeah. And I think you what's held us back, at least in the past have been the difficulty in opening these CTOs and relatively low success rates compared to the success rates that we enjoy with non CTO lesions. So maybe just bring us up to date in 2022, what sort of success rates might we expect with treating CTOs?

Dr. Prasad: Historically we've quoted success rates of around 70% but actually when you look at data for the nationwide registries, it's closer to 50 to 60%. Currently often you'd see in published papers success rates close to 85, 90%, but remember these are operators who are doing a hundred CTOs a year. In our hands, I would say success rates are about 70 to 80%, maybe just a tad over that, but case selection matters a lot to get those success rates.

Dr. Bell: Yeah. And I know personally that you're doing the more complex CTOs in the lab, so your success rate that's getting to 80% or so has to be considered to be reasonably good.

Dr. Prasad: That's very relevant, I think we're choosing more complex CTOs than we ever did before.

Dr. Bell: Right. So in terms of this improvement and procedural success that we've seen, what do you put that down to? Is it the equipment? Is it the operator? Is it patient selection or all of the above? Maybe just--

Dr. Prasad: I think it's all of the above but I think number one is the equipment. I think that has changed a lot. I mean, we have much better dedicated wires. If you remember Malcolm, in the old days we didn't really have anything specific. We just used more of what we had to do other PCI but now we have a whole car of CTO dedicated equipment. So that's the first thing, of which I think the wires and the quality of the wires is the biggest part and microcatheters. I think skill sets are very important. I think like anything else we do, that's procedural, volume and institutional experience matters. And so I think doing CTO intervention really at high volume centers makes a huge difference. And so in other words, adequate training. Many of us have learned as we've gone along, but of course many young fellows are now doing dedicated CTO training. And this is almost being seen as a subspecialty of PCI intervention.

Dr. Bell: So Abhi, do you think every interventional cardiologist should be skilled in tackling CTOs?

Dr. Prasad: I don't think so, Malcolm. I think increasingly the way this field is evolving I think each major cath lab needs to have one or two, probably two, if not three operators depending on the size of the practice, who dedicate their time to doing these cases because these cases are long. The field is evolving rapidly in terms of equipment and skill sets. And I think just like structural has evolved into its own field, I think CTO intervention needs to be thought in the same way.

Dr. Bell: And any comments to make about tackling these as an ad hoc procedure when you first do the diagnostic angiogram or is it something that we should step back and plan a strategy and maybe walk us through what you might learn in terms of planning the procedure and what additional equipment you might need, doing it on a specific day when you are focused on that CTO?

Dr. Prasad: Sure. Well, I would say the virtually all CTOs that we do are not done ad hoc. We bring them back on a specific day that we dedicate as a CTO day. Those days we have at least two operators to do most of the CTOs and we don't really differentiate between simple and complex when we plan our days, because you never know when a simple case will become complex. So we always plan for two operators. Should a CTO ever be done ad hoc? I could never say never because they could always be a very simple one with a microchannel that you could do ad hoc, but I would generally discourage against that because I think one has to take a very systematic approach if you want those high success rates.

Dr. Bell: So maybe for the non-interventionalist who maybe listening to this, could you maybe just briefly walk us through some of the additional things that we may be considering, and I'm thinking about vascular access, is it single, is it dual access? And maybe just explain what an antegrade approach is versus a retrograde and when these might be used in concert?

Dr. Prasad: Sure. So I think planning a CTO intervention is really important. And by that, I mean, studying the angiogram. It's fair to say that one you spend about 10 minutes looking at an angiogram looking at proximal cap, distal vessel, collaterals and that implies that inadequate image has been taken in the first place. So in most labs, I think people are now aware of, the importance of taking good images, long runs and not panning, and eventually on the day of the CTO we do biplane imaging to really make sure that we've understood the anatomy well. So studying the angiogram and that then allows us to plan the approach. And as you said, Malcolm, there are essentially two approaches, there's an antegrade approach or retrograde. Even though people have heard a lot about retrograde really the vast majority of CTO interventions today, and perhaps even increasingly so are done antegrade. I would say three quarters if not more are done antegrade. And then the question is it antegrade wiring or a dissection reentry technique probably speaking. And again, the vast majority are done by wiring and in part that's because the wires have improved so much over time. So antegrade wiring is pretty much as you would wire any non-CTO case except it's just much more slow and painful work, making sure you understand the anatomy well and use these dedicated wires to travel slowly through the plaque itself. Now, occasionally either intentionally or unintentionally you end up in the extra plaque area and that's really the dissection of re-entry because once you've entered that space outside of the plaque but in the blood vessel itself, then there are techniques where you could make a lot of headway using hydrophilic wires in that extra plaque space, and then reach the distal cap and re-enter either again using the wire itself or dedicated balloons to re-enter. So that's the dissection of re-entry technique. And these again, techniques that really require a lot of experience and high volume operators to do effectively.

Dr. Bell: And in the same context, maybe you just briefly describe what the retrograde approach...

Dr. Prasad: Sure. So the retrograde approach has been around for decades, originally described using vein grafts, included vein grafts that we use to enter the vessel distally and then make a path retrogradely towards a proximal cap. Nowadays, we often use the LAD to go through sepal collaterals or the right coronary artery, either way most often, LAD to the right, using the sepal collaterals which are often visible but not always. Sometimes you can even just use invisible

collaterals by just kind of feeling your way through the septum. And the goal here is to really reach the proximal cap via this retrograde approach and then have an antegrade wire and then connect those two spaces that you have those two wires in. And ultimately the goal is then to finish the angioplasty in an antegrade fashion. I hope I've tried to make that as clear as possible.

Dr. Bell: No, you have. And I think your people would appreciate then that when you think about, I mean everyone's seen an angiogram and seen collaterals and I think this is where, the development of some really neat and very small and steerable wires come in, because you're actually going through those collaterals, which decades ago you would never have considered. Which then sort of brings up the question, now you're working in territory that, we not often working in those collaterals. You've talked about dissection and re-entry and I'm sure people would wonder, well, what are the risks associated with that? So just walk us through that. Obviously there's the risk of perforation. So maybe we'll just start with that and how often does that occur and then would you deal with it?

Dr. Prasad: Sure. Yeah. If we think back to how we were trained, pretty much everything we do in the CTO area brings some of those expertise but doing things that we were taught not to do create dissection in going to collateral So, absolutely. So there are unique risks. Of course perforation because of the wires and stick wires and so on that we use. That said, I think with contemporary practice and scaling back... I mean for a while, the complication rates were increasing with CTO interventions. But I think as we've understood more, I would say that the risk is around three to 5% at the most. And it's a range. So with antegrade wiring the risk is actually pretty low, two to 3%. It's really with the retrograde intervention that we see the higher complications. And even there, it's probably three to 5%. The largest risk of course other than preparation is injuring those collaterals particularly with retrograde. And that's one of the reasons that we have limited our practice to mostly doing them through septal collaterals because the septum, as you could imagine acts like sort of squeezes on those septals to prevent extrapolation of the bleeding. So septal collaterals are the safest but you can injure these collaterals and cause major hematomas that can be life threatening within the septum itself. So perforations either of the collaterals of the actual vessel are the biggest concern. In the retrograde kind of approach, the other thing is donor vessel injury, that's a big deal, 'cause you're going through a vessel that otherwise may be free of disease. And if you injure it you could end up with two vessel injury. So we take great care when doing retrograde cases. And here again, you could have dissection, embolism, thrombus of the donor vessel.

Dr. Bell: So when we typically do an elective PCI, we're expecting an extremely low mortality associated... I mean, immediate mortality. Is that risk increased in patients undergoing PCI of CTOs?

Dr. Prasad: I would say not. I think mortality rates are exceptionally low. It's mostly these other complications that lead to that higher complication rates.

Dr. Bell: But you can deal with that?

Dr. Prasad: Yeah.

Dr. Bell: So it brings me to the final question then is, what can you tell us about what data we have to inform us on whether we are truly improving patient outcome, particularly with symptoms and maybe even survival, recognizing that your CTOs is a very common reason why we do not completely revascularize or, well yeah, completely revascularize someone with multivessel disease. So what data do we have that we can discuss here?

Dr. Prasad: So let's think about death and MI, the hard endpoints. Well, as everybody, or most people will be aware in stable patients we don't change that, and that's true for CTO interventions too. The decision CTO trial showed that, it was a trial of about 800 patients done in Asia where they randomized patients to optimal medical therapy or optimal medical therapy plus CTO intervention. And there was no difference in outcomes at three to five year follow up. So I think it's fair to say that we can't change so-called hard endpoints. But what we can change is symptoms. Definitely Euro CTO and OPEN-CTO registry, both showed very convincingly that the ischemic burden, the symptoms, both chest pain and shortness of breath can be decreased, quality of life improves. And in fact, in some patients who have depression you can decrease depression related to their symptoms. So I think there are several outcomes that we can think about or talk about that we can improve upon.

Dr. Bell: So summing up what you said then it seems that it's appropriate to consider PCI of CTOs in selected patients who are symptomatic, as long as it's been done by operators and with the appropriate expertise, that we're not rushing into this as an ad hoc procedure that it's something with careful planning and that we also obviously need to involve the patient in that discussion. One of the advantage is in just not doing it as an ad hoc or procedure, they need to understand the complexity of the procedure as well as the, I guess just the added risk of perforation. And let's just say maybe the mortality isn't higher but obviously that would be a serious complication that they'd have to deal with maybe over a matter of a few days, but is that fair? Is that the message that you want to put out there?

Dr. Prasad: Absolutely. I think these procedures need to be thought out carefully. The patient needs to be involved. And the key thing is to specifically outline the risk and benefits in terms of procedural success rates being not maybe as high as otherwise and the specific complications. But having said that I think it's a very valid thing to offer to the majority of patients who have CTOs.

Dr. Bell: Okay. Well, thank you very much, Abhi. I really appreciate you sharing your experience as well as your expertise in this area. And as I said, I think it does seem appropriate that we should be selecting patients for this procedure but really does need to be done in an institution that is experienced and has the appropriately trained operator. So thank you so much for your time today.

Dr. Prasad: Thank you, Bell.

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