

[MUSIC PLAYING]

**KRISHNA** So my task in the next 10 minutes or so is to discuss some practical and technical aspects of coronary bypass  
**TUMMALAPALLI**, angiography and intervention. So this is my conflict of interest statement. I'm a consultant to Terumo  
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So we've all heard this comment. So the radial approach is not suitable for bypass patients, choose left radial if the patient has a LIMA. Then we heard, forget radial if you have a RIMA, LIMA, and few vein grafts. Not enough guide support for radial approach, and too much radiation, and too much procedural time. I'm not going to discuss this final aspect, Dr. Cohen has a nice presentation on that.

So I'm going to touch up on these following aspects. So I found the answer for all those questions after my Chinese dinner.

[LAUGHTER]

Where the fortune cookie summarized, "You will not know what you can do or cannot do until you try." So OK, you have a patient with bypass graft angiography. So you can take a picture of the vein graft, in this case, sequential. And then you also take a picture of your mammary graft to the LAD.

So the question is, how do we do it? What are the technical aspects? So there is still a debate that goes on whether we should use the left radial or right radial for bypass patients. And many people prefer left radial, thinking it's exactly similar to the Judkins approach, which is not really true. There are some technical aspects we have to be aware of, because the angulation from this subclavian to the ascending aorta is different than a Judkins approach.

But typically the catheters that would work from the femoral approach would also work from the left radial-- JR4 from the right grafts and right coronary, JL3.5, Tiger, Amplatz catheters, Jacky, multipurpose. I particularly like RIM catheter for visualization of the LIMA, which I will have an example of too. And then if you choose to go from the right radial, which is my preferred approach for all patients with bypass graft, whether they have LIMA or RIMA, that's my first approach.

So I use any of a number of these catheters, Tiger, Jacky, Amplatz, JL3.5 for multipurpose. And LCB catheters would also work for bypass graft visualization. I try to do the cases with a so-called single catheter technique. I go with the preferred approach would be a Tiger catheter with a long wire. And usually that works for native coronaries, vein grafts, as well as for the LIMA.

But generally, if you have an SVG to RCA, multipurpose would work well. The bypass graft to the left side, circumflex and LAD systems. The Tiger, Amplatz or LCB catheters would work. And if the patient has dilated aortic root, then you may want to choose Amplatz or LCB catheters.

Another practical trick I found by doing these cases was at times you may have to use an EBU or an XB guide catheter to visualize the grafts, because there is less chance of them being kinked, and also you have more tractability if you use the guide catheters. So in experienced hands, the transradial approach for a bypass grafts has a similar procedural time.

So let's share an example of the visualization of the LIMA from the left radial. Unlike many people's belief that the Judkins catheter, the LIMA catheter from the femoral approach would not work very well for the visualization of the LIMA from the left radial, because of the angulation of the mammary from the subclavian. Sometimes it would be a more than 90 degree angle. So a Williams three-dimensional right catheter has been used, and intermammary VB1 catheters have been used.

And as I mentioned, I like the RIM catheter, it's a 5 French catheter, 65 cm length, and it has a nice curved tip. So here is an example of this catheter. So you advance the catheter beyond the origin of the mammary, and by pulling, and pushing, and by manipulating, you enter the mammary graft. And you can have a nice selective injection of the mammary, in this case to the diagonal and LAD.

So the real challenging question then is, how do you visualize the LIMA from the right radial? So many number of catheters can be tried, the LIMA catheter, RCA catheter, hockey stick, JL4, and 5 French Tiger would work well. You need to use a long hydrophilic wire to pass the wire all the way into the subclavian, and almost close to the left brachial artery.

Sometimes you may have to use the BP cuff, and sometimes bending the elbow might help too. And of course, you need some patience. I'll talk about the BP cuff and bending the elbow in a little bit.

So what if-- the question also comes up-- what if the patient has a LIMA and a RIMA? I choose right radial preferably, because it's always easier to get the LIMA from the right radial than RIMA from the left radial. We'll have some examples. So here is the technique on how you visualize the LIMA from the right radial.

So the idea is that on purpose you passed the whatever guide wire that you have-- hydrophilic wire would work best-- all the way into the descending aorta. And then you flip the catheter towards the subclavian, and with some practice, you can enter the subclavian with the guide wire. So here is how it works.

So here, we are trying to pass the wire. Sometimes it can go into the carotid or vertebral artery, and then you pull back, and I'm pulling back the catheter now, and advancing the wire more into the descending, advancing the Tiger catheter, it happens to be in this case. And then we turn it upwards, try to hook up the subclavian. And once you have the subclavian, then you advance the wire all the way into the-- as deep as you can.

The key is you need to advance the guide wire as deep as you can, that's when the catheter will track the wire, and that goes beyond the subclavian. So if the wire goes, and still you are having trouble, that's when you use the BP cuff on the left arm, and try to compress the artery so you'll have more anchoring capacity. Or you can ask the patient to bend their left elbow.

So after that, then you track the catheter, and make the catheter beyond the origin of the LIMA. And then with some manipulation, you can do a nice visualization of the mammary graft. One has to be a little cautious in pulling back trying to engage the LIMA, because you can completely flip, and fall down into the descending aorta again, and then you have to start the whole process again. So that can add extra time.

So what is the technique for visualization of the vein graft? It's really the hand-to-eye coordination. Most people work in the left anterior oblique view, I sometimes tend to use the eye-level view, where you have these two nice markers, by just turning-- you know you had to turn the catheter anteriorly-- and try to hook up to this bottom graft here, which happens to be the diagonal graft.

And once you visualize that graft, in this case a very small graft, supplying not much of a myocardium. And then all you have to do is lift it up. And generally, most of the time, it will fall into the superior graph, hooks up, and then you can take a nice picture of that vein graft as well.

But a lot of times we do get tough patients, mostly elderly patients, octogenarians, and sometimes these vessels are very calcified and rigid. They do not heal and accept the catheters and wires as easily. We all have that experience.

So one tip for those patients is I tend to use, for the LIMA visualization, a 4 French LIMA right coronary catheters with a long hydrophilic wire. And we use the push and pull technique. Basically, what that is here is the Tiger catheter would not go up, it just prolapses into the descending. So I switched to a right 4 French catheter, as you can see, while I'm pushing the catheter here, and pulling the wire.

So by push and pull technique, we are nudging and advancing the 4 French right coronary catheter. And we take a picture here. Obviously, this is a sub-selective view, but sometimes we may have to settle for sub-selective view, similar to we all do for femorals sometimes. Or, the other option is use bail-out, switch to the left radial or right femoral, whatever your preference might be.

So the other group of patients that will give us trouble in getting the angiography is the tough SVGs. These are the patients who have dilated aortic roots, they have short ascending aorta, very tortuous innominate or subclavian vessels. Our particular interest is the high origin of the SVGs. Here is an example of the short ascending aorta.

So as you can see here, while I'm trying to address the catheter into the ascending aorta, because of the short root, the whole catheter and the wire are flipping into the descending. So one way to solve that problem is to let the guide wire advance over the arch, and into the descending. Now you have more anchoring capacity, and then you can advance the catheters wherever you want.

And then the other problem that might happen is this patient happens to have a LIMA, RIMA, and two SVGs. So there was no difficulty in getting the LIMA, so that part is taken. And then I had a hard time getting the rest of the coronaries and grafts.

One point I like to make here is look at the rings of this vein graft. They are much, much higher in the ascending aorta. So this is the area where it's very difficult to engage catheters into this area. Some people refer to this as so-called blind spot. So that's the reason why it is difficult, because you can see the angulation of the arch, and the origin of the innominate.

So we had to switch to multiple catheters. In this case, we happened to do the right coronary angiogram at the AR2, and they AR2 also worked for visualization of an occluded graft. And then multiple catheters were tried, but I like to point out that sometimes, as we said, we may have to use guide catheters for diagnostic angiograms. And this is one of those cases where I had to use the LCB catheter, which I had a better control, and visualized this vein graft to the circumflex marginal system.

So here is an example of that in the eye-level view. And after visualization of that graph, on the way, the other point is that the LCB catheter can also be used for visualization of the native left main coronary artery, which I have done in this case. And subsequently, on the way out, same catheter was used to visualize the RIMA to the right coronary.

So even if the patient has vein grafts, LIMA, RIMA, it can all be done with a radial approach. Now, spending a few minutes on the graft intervention from the radial approach. So the guide catheters, again, multiple guide catheters can be used, Amplatz 1, 2, they are particularly useful for dilated roots and circ system vein graphs on the left radial.

Multipurpose would work very well for right coronary graft, JL4, EBU, XB for left-sided vein grafts. And we can also use the dedicated graft guides, Tiger and LIMA guides for the LIMA, and Ikari left would also work for left-sided vein graphs. So any of these-- so the point, again, is whatever is comfortable for you. What works for you may be different from what works for a different person. So we need to find out what it is.

So as far as the PCI options, you can do almost everything that we do from the femoral, also from the radial-- FFR, distal protection devices, IVUS, thrombectomy, stents. Me stents. And for guide support, we could also use guideliners to get equipment delivered to wherever we need to deliver.

So the radial principles are really the same as femoral approach. You need a stable guide, and same PC equipment. I prefer monorail system, and also, because we are doing radial, we can be liberal with our anti-coagulation and antiplatelet therapy. And just to briefly show you a couple of examples, here is a decent rated vein graft to the marginal branch. Very much older graft, so in this case, this is eye-level view.

We used a filter wire, it's hard to see, but there's a filter wire here. And we stented the vein graft, and then this is the post-procedure. Good result. And then here we have a patient with long SVG lesions, you can see the whole graft from the top, all the way here. From here to here is all disease.

So you could also do the long lesions. Here's one stent going up, another stent going up, and then we have a nice result on the vein graft, with good feeling, good flow, three big branches. And also yes, you can also do intervention of the LAD via the LIMA and from the right radial approach.

And here is an example. So we have a nice LIMA filling the LAD, but the LAD has disease, a hazy looking active lesion, and we were able to do the wiring and stenting, and the final result. So anything we could do with the femoral approach can be done the radial approach. And in fact, actually, compared to the LIMA guide from the femoral, the 6 French Tiger guide from the right radial would actually sit better and give you really nice support as well.

So in summary, I would say bypass angiography and PCI is feasible from radial approach in patients with multiple vein grafts, and even in the presence of LIMA and RIMA in the same patient. So LIMA can be visualized in vast majority of patients from the right radial. And I can honestly say my success rates are now approaching 90%. Occasionally I do have to bail out.

The PCI principles are the same with radial approach as with femoral approach once the guide catheter is engaged. And again, with experience, our procedural times are similar. So I'll stop here and entertain any questions.

[APPLAUSE]