Marco A. Costa, MD, PhD

An expert in cardiovascular diseases discusses his preferred assessments, treatments, and tools of the trade, as well as tips for medical centers that wish to optimize their resources.

What steps do you take to ensure optimal stent strut apposition in the coronary vasculature?

Stent apposition is defined by the attachment of the struts to the vessel wall, and the only way to assess this is by using intravascular ultrasound imaging. There are two imaging modalities that provide this technology, one is intravascular ultrasound, and the other is intravascular optical coherence tomography (OCT).

The preferred method that I use is intravascular OCT because it provides a much higher resolution and allows me to look at a very small level of the stent position, which intravascular ultrasound would not be able to detect. The second reason I prefer OCT is because the presence of calcification, which is very common, usually blurs the intravascular ultrasound image, and therefore, I am not able to assess the stent position in that situation. Usually, malapposition occurs in areas with calcification because the stent cannot conform to the vessel wall. Currently, we check for apposition via OCT as opposed to ultrasound.

The time point at which we make this assessment is immediately after stent implantation, so that we can manage, adjust, and further dilate the stent, if needed. This is not only done to check whether the stent is malapposed but also if the stent needs to be further expanded, and you can do this while you have access to the vessel. We don't routinely perform follow-up assessments with imaging, unless it is clinically indicated.

It seems that the utility of intravascular OCT is continuously expanding throughout the field of interventional cardiology. What role does it currently play in clinical device trials?

Most new stent technologies have already passed that phase of testing, but some are still undergoing trials and using intravascular imaging, particularly intravascular OCT, as the predominant method. It is used to assess exact strut coverage by neointimal hyperplasia, stent apposition, as well as the presence of thrombus, which is not properly assessed by ultrasound. Biodegradable stents are also one of the new technologies that have been using OCT assessment. Intravascular ultrasound provides limited value when assessing biodegradable stents because the polymer creates a blurred image.

What treatments do you consider once a vulnerable plaque is detected?

The most important part of the imaging assessment is to determine the extent of the disease so that you don't have geographical miss. By properly assessing the extent of the disease, you will be able to cover the entire diseased area with the stent. As far as plaque morphology and characteristics, the only time that you radically change your approach is when you see an extremely calcified lesion, which is usually a very rare situation. But that would be a clinical situation when you change your approach to include a debulking technique in addition to stenting. It is possible that one might prefer direct stenting with soft plaques.

The most important aspect of the treatment strategy in the presence of thrombus and in acute coronary syndromes, particularly non–ST-elevation myocardial infarction, is that you don't know exactly where the culprit blockage is (ie, there is no angiographic signature to define your target in patients with multivessel disease). I think that's probably the best indication for using intravascular OCT, so you can precisely define where the plaque rupture is and treat the culprit vessel, knowing that you are treating the right vessel as opposed to flying blind on angiography.

Which cases are best assessed by frequency domain-OCT?

Certainly, as I mentioned before, preprocedural vessel/lesion assessment is probably the most applicable use of this technology. I think that in cases of acute coronary syndrome and bifurcation disease in vessels with extensive disease, or in large vessels (eg, left main, proximal left anterior descending, and proximal circumflex arteries), there should be no chance for error. Although the chance of complications is small, it is potentially catastrophic in such cases. That covers about 85% of the cases that we see in our daily practice. Do we use this technology 85% of the time? Probably not, as it would become time consuming and costly, but I could also see the value in utilizing it more than we do today.

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To your knowledge, is there an active plan to continue researching the optimal antithrombotic treatment in patients undergoing transcatheter aortic valve replacement (TAVR)?

I think TAVR is still evolving and maturing. Our understanding of the embolic phenomena still needs to be refined. The perception that embolic protection devices will be the solution to the cerebrovascular events that may occur during the procedure might be misguided. I don't think that this form of protection will be the solution, at least with the technology that has been developed so far. Improving the optimal antiplatelet therapy and anticoagulation regimen for these patients, particularly those with atrial fibrillation, which is probably one of the key players in stroke occurrence, might be a better first step to prevent strokes.

You have to remember that half of the strokes occur after the procedure, so using an intraprocedural device will only prevent half of TAVR-related strokes, at best. But we must also take into account that placing an extra device may actually increase the stroke risk.

I think we have significantly improved our protocols by using lower doses of heparin, making sure that the patients are anticoagulated before the valve is deployed, and maintaining anticoagulation with antiplatelet therapy, which is dependent on whether the patient has atrial fibrillation or not.

There is a study by Josep Rodes-Cabau in Canada that is trying to define the role of anticoagulation in patients with atrial fibrillation. There are also studies taking place in Europe comparing aspirin versus aspirin plus clopidogrel in the chronic phase. But there is also a new generation of antithrombotic agents that might play a role and are being tested. However, most of these studies are relatively quite small and probably not powered to fully address the issue.

The volume of TAVR procedures still pales compared to coronary procedures, and that's why it's difficult to develop powerful trials because you need thousands and thousands of patients to prove that stroke is a substantial concern. It's also a multifactorial presentation.

As we move toward treating less comorbid patients, they will be less prone to stroke, as they tend to have less intracerebral, carotid, and upper aortic disease. During the procedure, the hypotension that occurs during valve deployment, even if it's brief, may lead patients who have intracerebral disease to have a small stroke, which is not an embolic event. There are many other reasons to have a stroke than just as a result of emboli. Emboli are created by debris or plaque dislodgement, and in a population undergoing antithrombotic procedures, you are not going to completely resolve this process.

In what areas do you think hospitals can improve in terms of operational management, streamlining, and efficiency?

I think the challenge that we are now facing in the cath lab is that we are seeing sicker and sicker patients for treatment with complex and costly procedures. There is a trend in treating less sick patients with conservative management, and the cost of noninvasive stress tests have caused difficulties for patients, so clinicians are becoming more and more conservative in addressing the problem of coronary disease early on via revascularization. By the time patients come to the cath lab, they come later into the disease progression, and for many of those cases, they have just delayed the process by a few years. Once they finally get to the cath lab, these patients have much more complex disease states.

I think the best thing for centers to optimize is to reduce marginal costs, from supply chains to the way technology is utilized, and avoid wasting resources on poor operational efficiency, which leads to more technology utilization that adds cost but does not provide true clinical value to patients. Additionally, minimizing the length of hospital stay is another critical aspect that figures into the cost of a procedure.

Those are areas in which administration can truly make an effort, but the phenomenon of moral hazard is making PCI a relatively costly proposition to hospitals because of the nature of the population being treated. We are dealing with complex patients, for which longer, more involved procedures are needed, as well as more stents being used. Then complications occur, and patients stay longer in the hospital; TAVR procedures, for instance, are very, very complex. Patients may stay weeks in the hospital either pre- or postprocedure. This is very costly for the hospital administration, but if they can reduce some of the costs of their procedures, they will be able to optimize to capture some of the value created. ■

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