Transcript Can CT Angiography Be Used to Track CAD Regression

Dr. Stephen Kopecky: Hello, my name is Steve Kopecky, a preventive cardiologist at Mayo Clinic in Rochester, Minnesota. And welcome to interview with the experts in cardiovascular disease. This is part of the Cardiovascular Disease Prevention Series. I wanna welcome Dr. Eric Williamson, professor of radiology here at Mayo Clinic. Thank you for joining us, Eric.

Dr. Eric Williamson: You bet Steve. Good to be here.

Dr. Stephen Kopecky: Eric's been very involved with research on some of the new CT scanners that can actually image coronary artery plaque. And the topic today is, can CT angiography be used to track coronary artery disease regression? So Eric, let me ask you, what is it about the CT now that it can tell us that we can actually attract regression?

Dr. Eric Williamson: That's a good question, Steve. The, you know, the honest truth is that we've known for a long time, right, that coronary CT angiography can identify not just calcified coronary plaque, but noncalcified, coronary atherosclerotic plaque. The problem has been that even though we could identify those various different elements, we didn't necessarily have the level of confidence that we really need to be able to quantify the amount of plaque so that we can watch the regression that you're talking about over time. And there used to be, as you know, from having ordered these studies a lot, you might order a study, it might be performed on one particular machine order, a follow-up study on that same patient, coronary CT angiogram a year later or two years later on a, a completely different technology. And the plaque would look different. And, and so being able to describe qualitatively what noncalcified and noncalcified plaque looks like is great. But, but frankly, for us to really talk about what you and I have been speaking about for years, right? Being able to meaningfully follow plaque regression, what we need to be able to quantify it, we need to be able to say, here's the, not just the types of coronary plaque that are present, but the amounts of the various types so that we can look at components and, and get to that level. And it has been, I would argue in relatively recent years that two things have come together. The CT scanner technologies gotten good enough to actually visualize the various different plaque components. And then the software tools have gotten to the point where, where now we do have a couple of different tools that can be used to generate quantitative metrics that, that allow us to meaningfully be able to talk about plaque regression.

Dr. Stephen Kopecky: That's great. So we, we do CT scans a lot for calcium, and calcium does not rupture. It does not really cause problems within the coronary artery. It's the lipid rich plaque. And that's what you can now quantify. That's it.

Dr. Eric Williamson: Yeah. That, that's it. Exactly. And you know, that you and I have used in our practice for a long time have used, you know, coronary calcium as frankly kind of a surrogate marker for, for worrisome disease. We know that, that that coronary calcification is a, is a reasonably decent measure of how much plaque is present in the arteries. But as you point out, that's not the scary stuff, right? We are, we're seeing the bit of the iceberg that's above the water, not the part of the iceberg that's below the water that actually causes the damage to the ship as it goes by. So that's, it is those noncalcified elements. It is the, the lipid ridge plaque in particular that, that we want to be able to see and ability to distinguish those components. Now with today's more modern technology is that, and that's really the key for us to be able to, to drive sort towards some of these endpoints, again, using coronary CT angiography as a, as a secondary imaging biomarker.

Dr. Stephen Kopecky: So we will have a, a later a podcast in this series on how we can achieve regression. This is more about how to measure regression. Now, when you, you measure, so you can delineate the plaque, some of the lipid ridge plaque, the calcified plaque, what about the in-between how do you determine, you know, which is which?

Dr. Eric Williamson: That's a great, it's a great question. The way that we have, have classically done, and I would argue still probably the best validated technique is simple hounsfield units, right? Which the, you know, that's the, you know, Godfrey Hounsfield guy who invented the CT scanner, one of the people who invented the CT scanner back in the day, the, the Houndsfield unit attenuation value has been the only tool that we've had for identifying different plaque components, frankly, since ct, particularly in the coronary system existed. And it is a reasonably decent marker for identifying calcified, predominantly calcified, predominantly noncalcified and calc- and noncalcified plaque kind of putting things into that strata. But as we drive deeper than that, right, and we, as we start talking about individual plaque elements or individual elements of a particular plaque, I think there will come a day when we move beyond house code units and we really start to talk about other radios features that are at this point, frankly, completely the, the purview of AI and artificial intelligence enabled techniques and technologies. For now, you and I look at plaque as calcified, predominantly calcified, predominantly noncalcified and entirely noncalcified. And we do that with, we do that with Townsville units.

Dr. Stephen Kopecky: So then if we have a patient and we've, we've shared patients that have had noncalcified plaque, lipid rich plaque, which is more the vernacular is vulnerable plaque to rupture. We can measure that and we follow them over time. Now, how quickly will these change? How quickly can you see regression with your scans?

Dr. Eric Williamson: That's a great question. So with, interestingly, you know, you, and you and I talk a lot about this, the, the, the various different hos for the unit attenuation values of the different plaque components are super important. But the way that, up until recently, the way that we evaluated a plaque was basically how big it was, right? And, and to be able to identify a, you know, a

millimeter or sub-millimeter plaque and be able to tell about meaningful differences, we need to be able to get our, our spatial resolution of CT scanning well under a millimeter. That's really only been possible, reasonably possible on an ECG gated CT examination in the last several years, certainly less than the last decade. So, so it, it really is driving towards spatial resolution and then, and, and then being able to measure individual plaque components that has, that has allowed us to identify changes in plaque volume. So I would say right now, if you send a patient, we do a CT scan today, you start them on really aggressive therapy, we ought to be able to see some degree of regression that the next, like the scan a year from now, I, I don't know that we can see it as quickly as, for instance, in IVUS could, but the year we can see meaningful changes in plaque, in, in plaque characteristics and volumes.

Dr. Stephen Kopecky: That's fantastic. And as we're doing now, what's coming next? What, what is ai, how will it influence this?

Dr. Wric Williamson: Yeah, so what AI is going to do, right? It's gonna take that incredibly time consuming method, right? Where you and I, you or I would task a resident or a fellow to go make little circles on, you know, these impossibly small images, right? What, what AI is really gonna allow us to do is to take that process and, and automate it. And, and it will be that automation, right? That that will be required for us to, to be able to scale this beyond one patient or a couple of patients, basically down to the point where it becomes an, a reasonable marker for us to follow on a large group of patients. And it is that scalability that is, that's gonna happen as a result of ai. And you're gonna see numerous AI enabled tools for plaque quantification and become FDA approved in the next year or two. And, and this will be part of clinical practice, which will hopefully begin to really allow us to take advantage of CT in this space for the first time.

Dr. Stephen Kopecky: Fantastic. What a, what a wonderful area. It's really at the forefront of this and 'cause coronary artery disease regression is what everybody wants to achieve. We all want to be grow younger, not older, and have our arteries open up. So we're doing that now where I think you're giving us great results and great information. Very, very, very helpful. But it's not gonna stay static. It sounds like this will rapidly progress. The AI in the next year or two you think will change things tremendously and will probably give us much more information. And we'll having this will be the part of the new armamentarium to measure plaque regression and improvement in our treatment rather than having to wait for a big event like a heart attack or a non STEMI or something like that. Exactly. Well, Dr. Eric Williamson, we've really enjoyed speaking with you today. You've given us great information. You're doing wonderful work with the CT scanners. We appreciate it greatly.

Dr. Eric Williamson: Absolutely.

Dr. Stephen Kopecky: So thank you for joining us today. Thank you for listening, and we'll see you next time.