**EPISODE 20: DIABETES AND CARDIOVASCULAR DISEASE**

**Rita Kalyani, MD:** Welcome to ***Diabetes Deconstructed***, a podcast for people interested in learning more about diabetes. I'm your host, Dr. Rita Kalyani at Johns Hopkins. We developed this podcast as a companion to our ***Patient Guide to Diabetes*** website. If you want a trusted and easy to understand resource for diabetes or to listen to previous podcasts, please visit hopkinsdiabetesinfo.org.

We are pleased to welcome Dr. Roger Blumenthal to our podcast today. Dr. Blumenthal is the Kenneth J. Pollan Professor of Cardiology and the Principal Developer and Director of the Johns Hopkins Ciccarone Center for the Prevention of Cardiovascular Disease. He was co-chair of the 2019 ACC/AHA Prevention of Cardiovascular Disease guideline. He is also recognized as an international expert in the cardiovascular risks related to diabetes. Welcome, Dr. Blumenthal.

**Roger Blumenthal, MD:** Thanks so much, Rita. It's a pleasure to be with you.

**RK:** Dr. Blumenthal, I was wondering if you could start off by telling us why is cardiovascular disease so important in people with diabetes?

**RB:** Well, Dr. Kalyani, it's, you know, from a lot of observational studies, such as the Framingham Heart Study, that if you're a man and have diabetes, you are about twice as likely to develop coronary heart disease or stroke. And if you're a woman and have diabetes, you're about four times as likely to have a heart attack or stroke. And it may be partly the company that diabetes keeps because people with diabetes, especially if it's type 2 diabetes, tend to be heavier, they tend to have higher blood pressure, they tend to have higher triglycerides, which are the blood fats and lower HDL cholesterol levels. And then it's also thought that the increase in blood sugar that goes along with diabetes may affect the ability of the heart arteries on the outside of the heart, and maybe the smaller ones on the inner lining of the heart muscle that may prevent those arteries from expanding or dilating as much as they normally would. So, suffice to say, people with diabetes tend to have other accompanying risk factors. And they're also maybe a vascular function effect that their arteries don't respond as normally as people without diabetes. And it may be that this also predisposes them to get plaque buildup in the arteries at a younger age.

**RK:** Well, it sounds like there's just so many different ways that the heart can be affected in people with diabetes. When we use the term cardiovascular disease, what does that exactly refer to?

**RB:** Well, thanks, it's great to clarify that. So cardiovascular disease refers to coronary heart disease which is usually narrowing of the heart arteries. Many times, that can cause a heart attack if the artery becomes nearly blocked and with a superimposed blood clot. Cardiovascular disease also refers to a stroke, which is many times we think of as sort of a brain attack; a blood vessel leading to the brain may become narrowed temporarily or over a longer period of time and can cause damage to the brain leading to neurologic deficit. Cardiovascular disease also encompasses heart failure. And that's basically the ability of the heart muscle to pump blood out to the rest of the body to satisfy its need, so that people with heart failure tend to get shortness of

breath at a lower level of exertion than people without the diagnosis of heart failure. Cardiovascular disease also includes peripheral arterial disease, which is narrowing of the vein arteries… could be aortic plaque buildup in the abdominal aorta; could be up in the thoracic, the chest aorta. So cardiovascular disease, we mainly think of it as heart attack or stroke, but it also includes heart failure and peripheral arterial disease. So peripheral arterial disease… think of the… especially the legs and maybe the aorta also.

**RK:** And as you describe, there's just so many different forms, if you will, of cardiovascular disease, so many different parts of the body that can be affected. It's known that we focus so much on prevention of cardiovascular disease, especially the relationship with increased morbidity, just associated complications and early deaths that people can see with cardiovascular disease, too. You know, prevention of cardiovascular disease is clearly a focus. Who's at risk for cardiovascular disease? Does everyone with diabetes have a higher risk of developing cardiovascular disease?

**RB:** Well, diabetes is associated with what we would say is considerable heterogeneity in risk, meaning that some people with full control diabetes, never get any cardiovascular disease or if they develop some atherosclerosis it's mild enough that it never causes a heart attack or stroke or heart failure. But some people with diabetes are much more prone to getting atherosclerosis or plaque buildup in their arteries. So, it's very hard to predict. And just like a lot of conditions, even cholesterol, that there's some people with very high cholesterol that developed very little atherosclerosis and some with average levels of cholesterol that can develop much more significant narrowing. So, I usually try to tell my patients to think in terms of these… So, you know, A stands for aspirin and anticoagulants or blood thinners. If someone with diabetes has significant narrowing in their heart arteries, we often will put them on a blood thinner like aspirin. B stands for blood pressure, and the normal blood pressure is less than 130 over 80 and even better, is less than 120 over 80. C stands for cholesterol, and we're much more aggressive in the cholesterol management of people with diabetes. And C also stands for cigarettes. D for diabetes — either prevention or management. And D also stands for diet and weight. And then E for exercise. So, we try to deal with all those factors in that 'A Through E Approach' and in someone who has diabetes. And as you will note, Dr. Kalyani, the cornerstone of prevention is sustained lifestyle improvements. And that's what we try to emphasize from a heart point of view, as well as for people who may have been diagnosed with diabetes.

**RK:** I really liked that approach that you mentioned… the A to E approach. It's very succinct and it really describes the different risk factors for cardiovascular disease. Some that you can modify, and some that might be harder to modify. You mentioned diet and exercise in the importance of lifestyle. Are there diets that are more heart-healthy than others? What do you tell your patients?

**RB:** So when we think about diet, I freely admit to patients that there's lots of controversy. Some diets may work better for some people than others in terms of helping people to reach a desired body weight. But the principles of healthy diet are more fruits, vegetables, fiber, and whole grains for most people; trying to cut back on saturated fat and cut back on foods that have a lot of sodium and sweets in them. So, I think, you know, we try to think about if a person is heavier than they want to be. We try to think about having them be more cognizant of

the total number of calories they're really taking in. And in cardiology, we often… if people haven't estimated their daily caloric intake, we often have them do that for a couple of days. We use something like loseit.com or myfitnesspal.com, and it's pretty amazing, Dr. Kalyani, that some people had no idea that they're taking in 2,500-3,000 calories a day. And once they are equipped with that information, we have them look at their printout of where the calories are coming from and try to make some of those lifestyle changes. And again, but it all comes back to more fruits, vegetables, fiber, and whole grains for most people. I think the healthy vegetarian approach, Mediterranean diet, DASH diet are very similar. And those are the main principles. And we have a low threshold also to have people once we've tried to make some initial changes to see a registered dietitian for more advanced counselling. And as you know, some people may have other conditions such as kidney disease that may affect what they put in their diet and other people may have presumed intolerance to certain foods like gluten in tolerance. So, a registered dietitian is one of the best friends of a cardiologist.

**RK:** I agree. We rely so much on our dietitians and the Diabetes Center, as well. I think that the emphasis on healthy eating is just so important and behavioral change, which is easier said than done, but has a tremendous impact when implemented appropriately. You mentioned atherosclerosis and I wonder if you could just define that for our audience. What does that mean?

**RB:** So, atherosclerosis refers to what we called plaque buildup. Plaque is what I explain to people, a waxy substance made of fat and cholesterol that's become hardened. And plaque builds up in the arteries over time. And for someone to have a heart attack, they almost always need to have at least a mild amount of atherosclerotic plaque and sometimes that plaque becomes unstable. And the tears split forms in what we call the fibrous cap, which is basically the boundary between the flowing blood and the softer parts of the plaque that contain cholesterol. And if that blood mixes in with that lipid layer in the plaque, that may also be a stimulus for a blood clot to form. So, the final common denominator of a heart attack or stroke is typically a blood clot. So, we know that if we go back to our ABC Approach that if we do a better job of controlling blood pressure, cholesterol, blood sugar, improve a person's diet, weight and exercise habits, that we can decrease the tendency for plaques to become unstable. So, in essence, the atherosclerotic plaque is a waxy substance are the end-products of this atherosclerosis process. We all develop some atherosclerosis over time. But there's certain ways to assess how much a person might have. It may be helpful when we're in the fence about whether or not to prescribe a cholesterol medicine or perhaps a blood pressure medicine.

**RK:** So would it be fair to say that cardiovascular disease, when you try to look at it in the body, really reflects the degree of narrowing of the blood vessels in some way?

**RB:** So that's a good point. I think we used to say what's most important thing is how narrow your blood vessel is. But more recent data suggests that the total amount of plaque burden may be even more predictive than whether or not someone has 50 or 60% diameter of narrowing. So, a lot of work that's come out of Hopkins in the multi-ethnic study of atherosclerosis indicates that quantitating the amount of plaque in the heart with a coronary artery calcium scan is one of the best predictors of who's at higher risk for heart attack or stroke over the next 10 years. But we really just use that coronary artery calcium scan in people who were on the fence about how

aggressive to be in terms of cholesterol-lowering, and many times patients, you know, would prefer not to go on a cholesterol medicine. And we would say that using the coronary calcium score can be a good tiebreaker.

**RK:** That's interesting. So it sounds like it's a combination of the amount of plaque in addition to perhaps how narrow the blood vessels become.

**RB:** Correct.

**RK:** You know, when we talk about diabetes, we often focus on glucose lowering. In fact, that's the central tenet for reducing what we call the microvascular complications, like eye damage and nerve damage and kidney damage. But when it comes to cardiovascular disease, that's always been a bit debatable, hasn't it? Whether glucose lowering really has an impact on risk reduction or reducing cardiovascular disease over the long term? What are your thoughts on that in terms of the role of glucose lowering for reducing cardiovascular disease in people with diabetes?

**RB:** Another good question, Dr. Kalyani. I think the totality of the evidence supports the idea that people whose blood sugars are higher are more likely to be susceptible to cardiovascular disease. However, it's often again that the company that these people with the higher blood sugar keep. So it's really the higher incidence of higher blood pressure levels, higher triglycerides, higher LDL, lower HDL, that's more predictive than whether a person's A1c is 7.6, or 6.8. So, I think it's definitely much more challenging to convince everybody that blood sugar control… optimizing that is going to necessarily decrease heart attacks and strokes. It may have a greater impact on what I call the microvascular system and microvascular disease. But you're right, I think that we don't need to be as aggressive and lowering blood sugar or A1c as maybe we may have thought 10 or 15 years ago.

**RK:** And when we talk about duration, how long people have had diabetes for, does that have a role in their risk for developing heart disease?

**RB:** Well, your colleagues have published several really nice papers showing that the longer the duration of diabetes, the higher the person's long-term risk is of developing congestive heart failure. And I think that's important for people to remember, especially blood sugars that are sub-optimally controlled, have a greater association with development of heart failure. And some of that heart failure may be related to stiffening of the heart muscles so that the heart muscle doesn't relax as well and be easier for fluid to build up. And we sometimes use the terminology of HFpEF, heart failure with preserved ejection fraction. But there's also data that sub-optimal blood sugar control will… may predispose more to some of the hardening of the arteries or acute coronary events that may lead to a heart attack, as well as weakening of the heart muscle and we call that HFrEF, or heart failure with reduced ejection fraction. But it's important to realize that we want to focus in on blood pressure, cholesterol, diet, and exercise as sort of the key factors and whether the A1c is 7.5 or 6.7 is not nearly as important as better control of these other factors.

**RK:** Yeah, I agree with you. I think when it comes to reducing heart disease or cardiovascular risk, blood glucose management is important kind of just as part of comprehensive care. But there are probably other aspects, which is a blood pressure lowering the cholesterol lowering and the smoking cessation, as you mentioned that, and the dietary changes and exercise that can really even more so perhaps reduce the risk of cardiovascular disease in the long term. So, when we talk about diagnosing cardiovascular disease, let's say atherosclerotic heart disease, what kinds of tests might you order in the cardiology clinic to help you decide if someone has cardiovascular disease?

**RB:** So, cardiologists used to do a lot more exercise stress test than we do now. We actually have several studies, one of which is called the Ischemia Trial, that 40% of the participants had diabetes. And all these individuals actually had a moderate to advanced decreased blood flow with exercise, we would call ischemia. And what we found in that study is that, you know, trying to open up narrowings that the person might have with an angioplasty stenting or bypass surgery didn't really decrease heart attacks or save lives. So, we, as cardiologists, we order many fewer stress tests. Non-invasively many times we can identify cardiovascular disease with a specialized type of a cardiac CT, a non-contrast CT, chronic coronary calcium scan. And you know, there are some people with diabetes who have no or minimal coronary artery calcium, and they're not inclined to go on an extra medicine for their cholesterol or blood pressure. And the finding of no coronary calcium is associated with a much better prognosis over the next five to ten years. But I think that many people will come to light because they've already had symptoms that led them to see a doctor and they were diagnosed with either a CT angiogram or cardiac catheterization to have narrowing in their heart arteries. And that's how we know what risks level they are. And we just tried to be more aggressive with our medical and lifestyle management in people who already have moderate to advanced narrowing in the heart arteries.

**RK:** Do you think that everyone with diabetes should be screened with one of these tests for cardiovascular disease that's, you know, been somewhat of a debate? I know, in some countries, that still are taken, you know, if you have diabetes, you get a stress test every year. What are your thoughts on that?

**RB:** So the current recommendations of the American Heart Association/American College of Cardiology are not to do routine stress tests in people with diabetes. And that's been supported by the data from the Ischemia Trial because what we knew in that study is that all of these people had decreased blood flow and had significant coronary artery disease. Yet the next step would be trying to open up one or more of those narrowing and in over the ensuing three to four years, there was no decline and cardiovascular events. And many people with diabetes will already qualify for strong consideration of a cholesterol-lowering medicine. If someone has, you know, at least a 5% risk of a heart attack or stroke over the next 10 years and has diabetes, then most guidelines around the world would recommend giving strong consideration to getting the cholesterol levels down lower and starting the statin anyway. So, I think we really just use the coronary calcium scan for the most part in individuals who are reluctant to go on a medication or not sure they think that their cholesterol levels are pretty good or average and they want to know if they really have already had some narrowings in the heart arteries. So, I think that's the way to look at it.

**RK:** You mentioned catheterization. Could you talk a little bit about what is that procedure? And what does it tell you after you do that?

**RB:** So a cardiac catheterization is a test that's usually done through the artery in the wrist, the radial artery or sometimes through the artery in the leg, the femoral artery. And in under some local anesthesia, a small needle was put into the artery and then through that a wire and then over that wire, a catheter goes up all the way to the aorta and then to the part of the aorta where the heart arteries come off and a liquid material called contrast dye is injected when it's invasive angiogram. If it's a CT angiogram, they can time it so the intravenous is put in the arm, they can inject contrast dye through the vein. And essentially, it's getting a roadmap of the heart arteries. And it's trying to determine whether there are significant narrowing in one or more of arteries in where they're located. But, you know, unless someone has an acute event with recent onset of discomfort or shortness of breath and pattern that's unstable, we try to work on modifying risk factors as best we can and not rush into doing cardiac catheterizations. Because you always have to think of what will you do with that data. But if indeed someone's having a heart attack, or strongly suspected of having what we call unstable angina, then a cardiac catheterization is often done.

**RK:** You talked about the use of a statin therapy, as well. I wonder if you could talk about what that is and what role it has in people with diabetes. Should everyone with diabetes be on a statin drug, even if they don't have a history of heart disease?

**RB:** So, what a statin medication is… is probably atorvastatin is probably the most commonly prescribed medicine in the Western world. The first statin came out in the market in 1987. And sort of puts in perspective that's so for many of us in the medical field, we're officially working at Johns Hopkins at attending capacity. We have tremendous data now — 35 years' worth of experience — and statins can often at a moderate dose can lower the LDL with lousy or bad cholesterol by about 40% and higher dosages that can lower it by 50%. And we have a great deal of data showing that in people with diabetes if we can get their LDL significantly below 100 — in many studies, certainly below 70 — that is associated with a much lower future risk of heart disease and stroke. So, a statin is given typically once a day, and I usually tell people that 90 out of 100 people have absolutely no problem with a statin. Ten out of 100 might stop it in the first six months, typically, because of either perceived muscle aches or an upset stomach. And of those 10 out of 100 that stopped the statin then you know, if you give them a little holiday, decrease the dose, maybe give it every other day than typically seven out of 10 tolerate a statin just fine. But you're left with about three out of 100 people that even giving a statin just two to three times a week, they still perceive side effects. And we have other medications that can also lower cholesterol that we routinely think about adding depending on how low we can get their cholesterol down with a statin. There's what's called ezetimibe; and then there's also the injectable medications called PCSK9 inhibitors: evolocumab and alirocumab. But for most people, when their cholesterol levels are not optimal if they have diabetes, the first medication that the guidelines would strongly recommend having a good discussion with the patient to lower their future risk is a statin medication.

**RK:** Yeah, it's been an interesting I know you and I both been involved in in guideline work to see how the guidelines have changed to more and more recommend statins for what we call

primary prevention to prevent cardiovascular disease, even in people without a history of cholesterol abnormalities. And that's a point of, I think, often confusion when I'm talking to patients, why do I need a cholesterol medicine when I don't have you know, high cholesterol? How do you how do you usually respond to that? Why would someone with diabetes benefit from a statin medication even if they have no history of high cholesterol?

**RB:** So the way I describe it, Dr. Kalyani, is that statin medications, lower cholesterol with a significantly reduced risk. And they may reduce risk by a quarter or a half, so 25 to 50%. And they reduce the risk of heart in the arteries that reduce the risk of heart attack and stroke. And I also to try to explain to people that what we now say is normal like an LDL cholesterol of 130, or a total cholesterol 200 or triglyceride of 150 is really not normal, that we now have shown in higher risk individuals that getting the LDLs down more in the 70 range as opposed to 130 or getting the triglycerides down below 100 is associated with fewer subsequent cardiovascular disease events. So part of it is sort of redefinition of what a lot of people think are desirable or average cholesterol numbers. And then just going through the preponderance of data that we really have since 1994, when we had a large study called the 4S Trial (Scandinavian Simvastatin Survival Study) that showed for the first time that given a cholesterol medicine once a day, in our case statin decreased total mortality from about 11.5% down to 8%. So since then, we've had lots of studies in people with diabetes, that've never had a cardiovascular event that showing that given a statin medication decreases subsequent cardiovascular events by 25 to 30%. And the more recent data suggests the more you lower the LDL cholesterol, the greater the long-term potential benefit.

**RK:** Yeah, those studies that you described are just so amazing, really, in the benefit that they showed for using statins, many of which are generic now and in their benefits for reducing cardiovascular events. And, you know, part of the reason as you say that the guidelines now recommend them for almost everyone 40 and above with diabetes to have a statin medication for primary prevention. It's great to hear them on statins pretty well. What might be some common brand names and generic names of statin medications that people might hear about or want to ask your provider about?

**RB:** Most of the statin used today are the more potent statins: atorvastatin, brand name is Lipitor®; rosuvastatin, brand name, Crestor®, simvastatin, the brand name, Zocor®. So, those are the three most commonly prescribed statin medications. And sometimes people if they've had trouble tolerating cholesterol lowering medicine because of muscle aches then the doctor may also think about pravastatin or Pravachol®. But the two most commonly prescribed throughout the western world right now are atorvastatin and rosuvastatin.

**RK:** One of the questions I often get from my patients is, “What statin should I take?” You know, is there a difference between the statins for cardiovascular prevention? What would you say?

**RB:** So I tell people that they're all cousins of one another. I usually try to focus in on the medications that have been used in the clinical trials that showed the most benefit. And most of the standards that have been used in most of the clinical trials with the most impressive results are atorvastatin and rosuvastatin. So those are, are typically the ones that are used. But even

though we may be giving the statin medication to lower their risk and lower their cholesterol, I tell people that it's just as important to work on improving their cholesterol and their other risk factors by trying to optimize their dietary and exercise habits and improve their fitness level.

**RK:** And how about the use of aspirin? You know, we talked about the use of statin medication for prevention of cardiovascular disease for some people who don't have cardiovascular disease already. What about the use of aspirin for primary prevention of cardiovascular disease for people who don't have a history? Do you still recommend that? I know there's been a lot of debate recently.

**RB:** So I was co-chair of the American College of Cardiology American Heart Association guideline on prevention of cardiovascular disease and we were really the first ones to look at the data and say that no longer should we reflexively give a statin for people over the age of 40 or 45, who have diabetes, or who may have some of the risk factors like high cholesterol or high blood pressure. That the benefit seen and some of the more recent studies, one of which was called the ASCEND trial that looked at people with diabetes, there was a test of 100 milligrams of aspirin versus placebo. And they did see a small decrease in coronary heart disease events, like heart attacks by about 12%. But the incidence of major bleeds or predominantly GI bleeds went up by about 30%. And there have been some studies that show a decrease in heart attacks with aspirin. Other studies have the 10 of the 12 to 15% range, but it does appear that GI bleed and GI upset is more common than we would have thought. So for someone who has diabetes, and has never had a cardiac event, we no longer routinely recommend aspirin. That might change a little bit if we knew that they already had a lot of plaque in their arteries — perhaps they had an ultrasound of their neck for some reason they have moderate plaque buildup there or perhaps they have a CT scan of their heart for one reason or another and they seem to have a lot of coronary calcium. So, we will individualize that recommendation. But generally, I tell people that we want to work on everything else from a risk factor point of view and focus in on lifestyle habits and our lowest priority would be considering to prescribe aspirin or not.

**RK:** Yeah, I agree. I find that more and more we're deprescribing aspirin people who've been on it for decades and taking them off because of the risks you described as bleeding and that maybe just you know a select few who might be at higher risk for whom we suspect there's more plaque or are more likely to be at risk of a cardiovascular event in the near future then we might consider aspirin for. But definitely in the elderly patients over 70, almost uniformly stopping. And it's such a change, isn't it from where it was before, where we were giving out aspirin much more commonly. So, you know, I think part of this also has to do with some of the newer glucose-lowering therapies that we have and other options we have to reduce cardiovascular disease. And so, I wonder if you could briefly talk about what those newer therapies are and what role they might have in the prevention of cardiovascular disease in people with diabetes.

**RB:** So in addition to the therapies that will lower blood pressure and lower cholesterol, we now have a number of studies that go back to a study with empagliflozin or Jardiance®, that showed that you could get a decrease in heart failure hospitalizations. And that's been replicated with a number of the medications in the class that's called the SGLT-2 inhibitors. And we with the congestive heart failure guidelines that were updated, they talked about having an even lower

threshold in people with diabetes with risk factors tried to start that sooner. Our primary prevention guidelines felt that it was still very reasonable for physicians to think about starting Metformin first, since it's generic and many people helps with weight loss. But then we have a low threshold for either the SGLT-2 inhibitors, or another medication class as the GLP-1 receptor agonist which seemed to have like a common generic name is semaglutide. And it also seems to have benefits in terms of weight reduction and decreasing it. So we have data that the SGLT-2 inhibitors do decrease the risk of cardiovascular events and the SGLT-2 inhibitors have a greater impact in slowing the progression of renal decline and reducing heart failure hospitalizations.

**RK:** Yeah, I agree with you. It's really an exciting time to have all this data now from these newer drugs and the SGLT-2 inhibitor class such as empagliflozin, and canagliflozin and then also in the GLP-1 receptor agonist class, too, such as semaglutide, as you mentioned, liraglutide and dulaglutide, in terms of the benefits for cardiovascular risk reduction, and then kidney disease and heart failure, too, as you talked about. And you know, I think more and more we're seeing these drugs used. Do you prescribe them in your practice as a cardiologist?

**RB:** We do, I think the challenge comes in when people aren't officially in the diabetic zone of an A1c of 6.5% or higher. And we're trying to… they're interested in the potential to augment weight loss strategies and lower risks with a GLP-1 receptor agonist. And also, sometimes, you know, we have to deal with the insurance companies who say that, even though SGLT-2 inhibitors seem to decrease heart failure hospitalizations don't have diabetes, so many times they will want the patient to pay a larger co-pay. So, a lot depends on what sort of insurance that a person has. But clearly, a cardiologist learned a lot more about the medications that you're an expert on. And the SGLT-2 inhibitors especially, seemed to be one of the cornerstones of our management of people have weakened heart muscle, which we call HFrEF or heart failure with reduced ejection fraction. So, we think about a beta blocker like propranolol or metoprolol; we think about an ACE inhibitor; an Angiotensin Receptor Blocker, or what's called an ARB; we think about an SGLT-2 inhibitor; and we also think about spironolactone. So, many times that quartet of medications are really the pillars of the management of people who have weakened heart muscles.

**RK:** Yeah, and I think that the coordination of care between us as cardiologists and endocrinologist and primary care providers, really in providing the best comprehensive care we can for patients and use of these medications. It's important because some patients might see their cardiologist more often, or they might see their endocrinologist more often or their primary care provider and really ensuring that those patients particularly with a history of cardiovascular disease, for whom they were studying in these trials primarily, but those also at higher risk, are given the opportunity to have the benefit of these newer therapies. And I agree with you the cost and the coverage continues to be a challenge, but hopefully one that we can continue to navigate in the future to really help patients get those medications. Just in terms of some parting words for our listeners, you know, we talked a lot about cardiovascular disease, long term development of cardiovascular disease; but what really concerns people is having an acute event, you know, having a heart attack. I wonder if just, you know, in closing you could tell us what that is. What are the symptoms that someone should be aware about and what they should do if they're concerned?

**RB:** So a heart attack generally refers to a blockage or near blockage of an artery that's at the site of where we had plaque buildup that's become disrupted. And there's a superimposed blood clot there that's fully or moderately narrowing the vessels of the blood flow to the heart muscle is significantly decreased. And if someone thinks that they're having a heart attack, it's usually symptoms that with chest pain and shortness of breath, and often the discomfort is sort of like a pressure sensation. Sometimes the discomfort will radiate down the arm or to the neck. And we recommend that people contact the 911 because many times that's a much quicker way to get a prompt treatment than if trying to get someone to drive that individual to the hospital. The reason we want to try to act early if someone's having chest pain, suspicious of a heart attack is that the shorter period of time that a blood vessel is blocked, the less long-term damage there may be. And we can in this day and age many times open up a narrowed vessel with urgent angioplasty and stenting. But I always like to sort of close in my visits with patients to remind them about the ABCs and say that you want to one A, for Assess the risk. Clearly, if they have diabetes, they're at much higher risk of heart disease or stroke and we need to be even more aggressive with lifestyle changes. A for aspirin or other blood thinners like anticoagulants, B for blood pressure and think about less than 130 over 80 and clearly certain blood pressure medicines may be even more effective when the heart muscle function has decreased. C for cluster management, and cigarette cessation. D for diet and weight improvements and D for diabetes prevention or management and E for exercise. I think if people think in those broad categories, that way they can help themselves lower their risk. And surely, if they have symptoms that aren't going away — chest pain or shortness of breath — that they're concerned about, it's better to call 911 and get evaluated to get an EKG done promptly. And sometimes an echocardiogram can really determine if someone is having a heart attack in that period of time.

**RK:** Well, thank you so much, Dr. Blumenthal, for sharing your vast expertise. I know I learned a lot today and I know our listeners have surely benefited from all the great knowledge that you shared. So thank you again for being here.

**RB:** Well, thank you and thanks to you Dr. Kalyani for all the great work you've done on these diabetes guidelines. These have been great help to non-endocrinologist and cardiologists like myself and primary care physicians. It's really been an exciting field in what we call this cardio-metabolic medicine and diabetes experts like you give a lot of credit for a lot of the advances that we've been making.

**RK:** Well, thanks so much. It's been great to work with great colleagues such as yourself, so thank you. I'm Dr. Rita Kalyani, and you've been listening to Diabetes Deconstructed a companion podcast to the Johns Hopkins Patient Guide to Diabetes website. For more information, visit hopkinsdiabetesinfo.org.

We'd love to hear from our listeners. The email address is hopkinsdiabetesinfo@jhmi.edu. Thanks for listening. Be well and see you next time.