EPISODE 23: DIABETES & PREVENTION OF KIDNEY 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.

On today's podcast, we are thrilled to welcome Dr. Daphne Knicely, an associate professor of medicine at the University of Virginia School of Medicine, and an expert in diabetic kidney disease. Dr. Knicely is also the physician leader for home therapies at UVA dialysis. Today Dr. Knicely will be talking about prevention, risk factors and staging of chronic kidney disease for diabetes. Welcome Dr. Knicely.

Daphne Knicely, MD, MEHP: Thank you so much for having me.

RK: The area that we're going to be talking about today, kidney disease and diabetes, is always a question that I feel comes up when I see my patients and something that many patients are worried about in terms of complications from diabetes. I wonder if you could start off by talking first about the role of the kidneys in diabetes. Why do we even worry about kidneys when someone has diabetes?

DK: Well, the hyperglycemia or that high glucose level that people have just affects the cells in the kidney and it causes them to change and causes kidney damage or scarring. And if you think about kidney disease, there are 37 million people in the US with kidney disease. The number one cause is diabetes, at least in the developed world, and then after that is high blood pressure and then a scattering of other things. One in three will develop some sort of kidney disease. That's probably close to 12 million or so that might develop kidney disease. That's actually a large portion of my population that I see.

RK: What do the kidneys do? Why might they be affected by diabetes?

DK: That's a great question. The kidneys do a lot of things, they don't just make urine. It's what is in that urine that's important and what they're balancing. I like to say that kidneys kind of do several things; one that they do is help get rid of water and they help balance the water we need in our body.

If you're in the Mojave Desert and you don't have access to water, the kidneys recognize that and you won't make any urine—they'll hold onto so much water, but you'll make a little bit to get rid of the toxins. Or if you enter some radio contest and drink 10 gallons of water—your kidneys recognize I don't need all of that, and you're in the bathroom all day afterwards.

They are also kind of the washing machines in the body, so they get rid of all those toxins, the chemicals, the things we take into our body; they get rid of it. They also kind of balance the acid in our body; they help get rid of it. We naturally make acid, and they get rid of that. And then they are the chemists; they balance all the chemistry in the blood. So, things like sodium, potassium, and chloride—things you see on your labs—the kidneys keep that in balance. They kind of taste the blood and they figure out—how much they need to get rid of and how much they need to hold onto. And then the kidneys also do a few other things that people sometimes forget about; they're important for bone health because they balance our calcium and phosphorus. And they are also important for vitamin D; they make it into the working form to make those strong bones. They also make a hormone that says, "Hey bone marrow, make red blood cells." Sometimes people can get anemic if their kidneys aren't working very well. And then they're also important for our blood pressure; they help regulate it. They recognize when our blood pressure's low and they're like, "Oh, I need to hold onto more fluid and more salt to raise my blood pressure." Or "Hey, my blood pressure's high. I need to try and get rid of this." Anytime the kidneys kind of screw up, these kind of go out of whack. And whether it's because of diabetes or something else, they can't do that sort of basic function.

RK: It sounds like they do so many things that I think we often forget about, and overall, really just make sure; I like that analogy of the washing machine, making sure that things are cleaned out and that all the toxins are filtered out of the body. Is that right?

DK: Yeah, that's exactly right.

RK: And I know you talked about high blood pressure and often people with type two diabetes in particular will have high blood pressure. How does that affect the kidney?

DK: Which came first, the chicken or the egg? - Did I have high blood pressure and it affected my kidneys, or do I have kidney disease and it's causing me to have high blood pressure? - It's kind of both.

So what happens is when you get changes within the kidney, whether it's diabetes or something else, then you get scarring in there and the kidney tries to compensate by revving up their hormone system. These hormones actually make the kidney filter more, and by increasing pressures, your blood pressures will rise because of the scarring within the kidney. In diabetes in particular because of the scarring that happens within the kidney and this kind of over-filtering that kind of happens early on in kidney disease. As the changes occur, then these hormones really go after whack and they try to change how it's filtering within the kidney and it ends up raising the blood pressure. And then you've got the high blood pressure that's going to affect the kidneys too. It's this vicious cycle. So blood pressure control is really important when you have kidney disease and diabetic kidney disease.

RK: That goes along with what we often recommend in practice and focusing on management of cardiovascular risk factors such as high blood pressure and high cholesterol. In addition to the high blood glucose and diabetes, how does high blood glucose affect kidneys?

DK: There's a bunch of different mechanisms. So, whenever you have high blood sugars, this sugar will change the cells within these individual filtering units. And when they change the cells, this prevents them from filtering just right and getting rid of the toxins the way they should. And the first sign is they start losing protein in the urine; that's an early sign that they have kidney disease.

I like to explain it with the analogy that if you think of these little filters as strainers for pasta and they're broken [laughter], so you're losing pasta in the sink when you're filtering. Then, if you think about all the hormone changes that happen, well, you're rinsing off the pasta with a fire hose. You just get more damage to the strainer and more protein loss, and it's just a vicious cycle.

The changes that happen in the kidney are from those high sugars and through a bunch of different mechanisms. That's a really big area of study. We're figuring out—well, what are all these different ways that the cells change, this inflammation, and these enzymes that happen and get revved up because of these high sugars? And they're looking to see if they can target these individual enzymes and these individual inflammation markers as therapies for kidney disease, and they haven't really panned out that much yet. It all kind of stems from high sugars. If you really control your sugars from the beginning, maybe you can prevent any of these inflammations and any of these changes that happen.

So that's kind of the general way it happens in the kidney.

RK: And I know when we talk about kidney disease, we talk about it often along with other microvascular complications, complications that affect the small blood vessels in the body and for the kidney, the ones that feed the kidney and affect the tubules and the filtration systems as you mentioned. I wonder if you could talk a little bit about the early stages of kidney disease and how it progresses to the later stages. Sometimes people associate kidney disease with dialysis, but that's not the only kind of kidney disease. In fact, that's what's called an end-stage kidney disease. I wonder if you could talk a little bit about the stages as well.

DK: Yeah, that's an excellent question. So, if we think about how many people have kidney disease in the US with, a large portion of them having diabetic kidney disease. There are 37 million people with kidney disease and only about 35 million; they'll stay the same; they'll be stable. They don't progress, 35 million. So it's a small portion that'll progress to having end-stage kidney disease or needing dialysis, or full-blown kidney failure. If we think about the progression of diabetic kidney disease, early on, before you ever have any chemistry changes or even any protein in the urine, which is an early marker, then the changes are happening if you have high sugars. And then once those changes start happening within those filtering units, you get these filtering units; they're filtering even more than what they should. If they're filtering a hundred percent normally, then they're at 120 or 140%. That extra filtering, you would think that that's a bonus, but over time, that's wear and tear. That's like the fire hose on the strainer, and when that happens, then you get damage to those cells even more. And once that happens, you'll start to have small amounts of protein in your urine. That's why, as an endocrinologist, you guys check for protein in the urine. Routinely, you're screening for kidney disease.

And whenever you start having a little bit of protein in there, that should be an early warning side to people: “Hey, I'm starting to have changes within my kidney. I need to really kind of get on the ball and focus on doing right by my diabetes and doing right by blood pressure to help it prevent from going any further." And then, over time, this high filtering and this more proteinuria that you have in the urine, keep getting worse and worse and worse. And eventually you'll start having changes in the blood chemistry. The creatinine that we look at on our labs and that GFR (glomerular filtration rate.) that we look at on our labs are going to start to change. The creatinine, if you think about it, comes from muscle, and you only pee it out. When it goes up in the blood, we know the kidneys aren't getting rid of it like they should. The higher it goes, the worse the kidney function. Not everybody has the same amount of muscle mass, the creatinine in one person means something different than another. They mean different amounts of kidney function. That's why we have that GFR on your labs. And it's literally how many milliliters per minute of blood the kidney's filtering, and it goes hand in hand with the creatinine. When the creatinine increases, the GFR is going to start to decrease, and that's going to be your signs that the kidney's not doing well with that, plus the protein in the urine.

And eventually, if you don’t change anything, it could continue to progress. Really, in some, in type two diabetes, particularly, they can have a rapid progression in their creatinine and GFR it gets worse and faster over time if they really don't get on the ball. And even if they could have regression in their amount of protein in their urine, they still might have missed the boat.

They started getting on the ball with their diabetes. And it's too late, and it's just going to continue to progress. If you think about it, if we think about that GFR about how well our kidneys are filtering normal aging, we'll probably lose about 0.8 a year after the age of 40. But if you have diabetic kidney disease, it's going to start going down by even more than three each year because of the diabetes that's affecting the kidneys.

RK: And GFR, glomerular filtration rate, is so important. So when patients look at their labs, the things that they might want to focus on if they're interested in seeing how their kidney is doing are the creatinine, like you said, and the GFR glomerular filtration rate, and then the protein, the urine microalbumin, which we check once a year. I wonder if. Someone was curious about, "Do I have kidney disease?" What kind of thresholds or numbers should they be looking for in those reports? And if they're told that they have stage two or stage three disease, for instance, what does that mean?

DK: That's a great question. So, I'll start with the GFR, so that's how we stage kidneys for chronic kidney disease; we usually say it's less than 60 unless we know somebody has a lot of protein in the urine or a biopsy of the kidney that shows there's something wrong with the kidney or some sort of imaging that shows us the kidneys aren't perfect; this is just in general for kidney disease.

But, for stage one chronic kidney disease, it's somebody who has a normal GFR more than 90. But they have one of those changes: a biopsy or tons of protein or blood in their urine, or imaging that shows the kidneys aren't perfect. Stage two is when that GFR is from 60 to 90 and they have those other findings as well. And then stage three is, if it's less than 60 but more than 30, and we break it down into A and B, which is, we split it at the 45 mark. And then if it's 15 to 30, that's stage four, and then stage five is less than 15. The majority of people tend to go on dialysis at stage five, around when that GFR is about 10, because that's really when they start having the symptoms of kidney failure. You don't have any symptoms before that. If you were focusing on your levels, most people have a range in their creatinine, and I tend to look at creatinine a lot for telling people what their normal is, because their muscle mass usually doesn't change that much over time. I'll say, "Oh, your normal creatinine is from one to 1.4, which is a little abnormal." They have kidney disease. But that gives them an idea, and it's never going to be the exact same during the day. So, their creatinine in the morning might be a little different than in the evening. That's why I always tell them there's a range and it's also going to fluctuate by what you drink. But typical ranges for creatinine are anything less than 1.2 is considered normal, I guess you'd say. Then for the GFR, like I said, less than 60 is typically what we look at, and that's usually when they're sent to see me about when they're less than 60. But they will be somewhat aging; a 90 year old's kidneys are not going to work the same as when they're 20; their GFR might be when they're 90 (years old), if they had perfect kidneys, but they might be 70; that's just normal aging. That happens over time. So I wouldn't focus on a specific number, but less than 60 is kind of where you would cut off. As far as the protein in the urine, there are different ways of checking it. There's, what you guys do, is that microalbumin, or it's technically a urine albumin to creatinine ratio, and normal is less than 30. I mean, normal, you really shouldn't have any albumin in your urine, but we don't really count it unless it's above 30. And then we kind of stage it as well; from 30 to 300, we say it's kind of moderately increased, and if it's above 300, it's severely increased. And then if it's 3000 milligrams or more, it's more concerning when it's in the thousands; we really worry about that because it's going to add to the prognosis.

The more protein you're losing in the urine, the more damage that's going on in the kidney, and the worse the kidneys could get over time. And then you could also do 24-hour urine on people. I don't tend to do those a lot anymore. Sometimes I do if I'm really questioning the amount of protein in the urine. But they're cumbersome; you have to catch every drop of urine through a 24-hour period. You have to wonder, "Well, am I supposed to catch the morning urine or do I dump it out?" And it's always collected wrong, even in the hospital. I don't do those very often unless I'm going to change some sort of management or something like that. And you can do those for albumin or total protein in the urine. And we can also do a urine protein to creatinine ratio similar to the albumin, because albumin's a type of protein, but albumin is more specific. And, the testing for albumin in the urine is more similar through institutions versus there's a lot of variation with when you do protein in general in the urine. And there's a bunch of other proteins that we lose in the urine too. I might check that once whenever I see someone, but for the most part, I always do urine albumin, and the cutoffs for the urine protein creatinine ratio are usually kind of similar to the albumin. In albumin, it was 30 or less, which is kind of normal. And then, for protein, it's 150 or less, and then 150 to five hundred is moderately increased, and more than five hundred that is severely increased, is what we say.

RK: That's really interesting to hear about the different stages of chronic kidney disease. And it seems like the higher the number, the more severe the disease.

If an individual is interested in knowing where they lie, it's really helpful to hear about the GFR (the glomerular filtration rate) in the urine, microalbumin, or protein to ensure that those are being checked at least annually, if not for the GFR, maybe even every three to six months, depending on the medicines they're on.

One of the questions that will come up is, What about your diet? If you have a lot of protein in your diet and you just finish talking about having protein in your urine, is that a good thing or is that something you would discourage?

DK: I think I spend probably the majority of my visits talking about nutrition because your diet does affect the kidneys. Some people hope that by changing their diet, they'll reverse what's already happened in the kidney, and that's not going to necessarily be the case. But it's definitely a therapy for the kidneys, is the way I would put it. It's part of the treatment plan. So talking about protein is really important in your nutrition. You want to get an adequate amount of protein, but you don't want to overeat protein. Because if you overeat protein, then your kidneys are going to try and get rid of it. And it is actually bad for the kidneys. If I were a bodybuilder, which I'm not, but if I was like drinking muscle milk in addition to eating three meals and I was doing so much extra protein to try and bulk up, I'm doing way too much protein, and I'm probably going to cause some damage to my kidneys by doing that. But I tell people that you want a normal amount, and the best way to think about a normal amount is a serving of a protein at each meal. That's all, and for women, it's the [size of the] palm of your hand. For guys, it's the deck of cards, because their hands are usually a little larger, but pretty much the palm of your hand or deck of cards. And that could be equal to two eggs for women or three eggs for men. That serving amount is for any land meats; your pork, chicken, beef, lamb, goat, all of those. And then, if you're talking about seafood, the protein's kind of made different. A serving of protein for seafood is about the size of a remote control, or I would say an iPhone, that size—we'll bring it up to modern times—an iPhone, maybe a Samsung Galaxy. I don't know; it might be a little big, but that's for seafood, shrimp, and fish. So, you can do protein at each meal. And then there are vegetable-based proteins, which can count as well too. If you're one of those real kinds of anal people that want a number, then whatever your weight is in kilograms, that's how many grams in a day you can have. If I'm 70 kilograms, which is about 150 pounds. But if I'm 70kg that is, I can have 70 grams of protein a day. If I wanted to add it up because greek yogurt has protein, black beans have protein in this and there's more. There's some newer data out there that vegetable-based proteins might be a little better for you if you have kidney disease in general. But I'm not; the data's not strong enough that I'm recommending all of my kidney disease patients be vegan, but maybe there's a benefit with doing a vegetable protein night for dinner or something like that. And then a big thing people really need to do if they have diabetic kidney disease or kidney disease in general is a low-sodium diet. Whether you have high blood pressure or not, a low sodium diet is very important. Because of that high amount of sodium, the kidneys are going to have to get rid of it, and it just adds more pressure on the kidneys to get rid of that sodium; more wear and tear and stress, and it can make the kidney disease get worse. I usually tell people less than 2000 milligrams of sodium a day. I think it's a teaspoon and a half or teaspoon and a quarter of salt is equivalent to that. And if you're really eating at home, cooking your own food, making everything from scratch, not using canned sauces or stuff like that, then you're probably less than 2000 milligrams a day in your sodium intake. But if you're eating out a lot, if you're using a lot of deli meat or hot dogs or TV dinners or what have you, you're way over 2000 milligrams. The normal American diet, if I just ate whatever I wanted, is 6,000-8,000 milligrams of sodium a day, which is way too much. This high sodium is also going to cause other problems, even for someone with a normal kidney function. If I went out and ate 10 bags of UTZ chips, I would have a little swelling in my legs, just for a day or two, because my kidneys have to catch up to all that salt to get rid of it.

And I like to say salt and water are best friends. Expect to swell a little bit if you have something salty, because it's going to retain water. There are other dietary changes that people may or may not have to make sometimes in kidney disease, especially diabetic kidney disease. They might have problems getting rid of potassium in their body just because of some of the damage that happens to the kidney. They might have to restrict potassium in their diet, and it's not because the potassium's causing damage to their kidney; it's just that their kidneys can't get rid of it.

We're helping the kidneys out by restricting it in our diet. But not everyone needs to do that. It's really based on their labs. If their potassium is normal, they don't need to. If they have to restrict potassium in their diet, it's all about moderation. It's not that you have to get rid of everything with potassium, it's about don't overeat potassium. If they're doing this, the big ones are oranges, potatoes, tomatoes, and bananas. If they're eating oranges every day, cut back to a couple times a week, or if they're doing a banana with their cereal every morning, then maybe doing only a couple mornings a week and doing blueberries instead, they're low potassium. Over time we try to restrict phosphorus in the diet or give people pills to help with that. And that's only if their phosphorus is high again. That's usually in the later stages of kidney disease, when they're getting close to needing dialysis, that we do that. With phosphorus-containing foods, the big ones are: it's in a lot of processed foods; it's a preservative. So some junk foods have a lot of phosphorus in them; chocolate does. That's usually inorganic phosphorus. So you absorb that really easily versus the kind of phosphorus in meats and dairy products; it's organic. You still absorb it; it's just not as easily absorbed. I tend to restrict people's kind of junk food where it's preservatives first before I start restricting their meats and their dairy products, because those are somewhat nutritious for them. And then, if they begin to not have anything to eat, I'll give them binders as well. Nutrition is a huge part of kidney disease and diabetes, and they're already having to control their carbs in their diet for their diabetes, and then, well, they should probably be on a low sodium diet too if they have high blood pressure or they start to have kidney disease.

Then if they start having high potassiums and phosphorus, they run out of stuff to eat. I really value a nutritionist or a dietician to meet with patients, and you want to meet with them early on. And with diabetes, you guys usually have access to a nutritionist in your clinic, and we can visit them. Sometimes they just have kidney diseases; sometimes hard to get them into a nutritionist and have insurance pay for it; it depends on what stage they are, but they're really valuable, I think. And nutritionists nowadays are not just telling you what you cannot eat; that's what they used to be like, "You can't eat this, can't eat this, can't eat this." They're really good about saying, "Well, you can't eat this, but what do you like to eat? Oh, you can eat more of those, or you can eat more of this." They've turned around to be positive and not all negative.

RK: Yeah, I agree. Having a nutritionist as part of the comprehensive care team is so important, especially if you have diabetic kidney disease. That it's another layer of nutritional modification, as you mentioned, for protein, sodium and then in the later stages for potassium and phosphorus. So the dietary modifications are so important and so key at every stage of kidney disease.

This has been so interesting and so informative, Dr. Knicely, to hear about how you approach your patients with diabetic kidney disease and the relationship between diabetes and kidneys which is so important to remember for health care providers but also for patients who are worried about the complications of this chronic disease.

Thank you so much for being here today. We truly appreciate all your expert input and advice.

DK: Thanks for having me, it was a pleasure.

RK: 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. which has all kinds of useful information about diabetes, including videos and animations, a lifestyle and nutrition blog and a comprehensive diabetes glossary.

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Thanks for listening. Be well and see you next time.