

EPISODE 26: DIABETES & HEARING LOSS

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 podcast, please visit hopkinsdiabetesinfo.org. For today's podcast, we are delighted to welcome Dr. Ronnie Dinkes, a licensed audiologist and the director of audiology at Johns Hopkins Bayview Medical Center. She earned her doctorate in audiology from the Arizona School of Health Sciences and holds a certificate of clinical competence from the American Speech Language Hearing Association. Dr. Dinkes specializes in diagnostic testing and evaluations and the latest in technology in hearing aids and devices. Her primary research interest is the impact of diabetes on audiology. Welcome, Dr. Dinkes.

Ronnie Dinkes, AuD, CCC-A: Thank you so much for having me today. It's truly a pleasure.

RK: Well, we are so thrilled to have you here today to talk about a topic that I think is perhaps not as recognized as it should be, which is hearing loss and other audiological problems in people with diabetes. I wonder if you could start off first by talking to us about how common hearing loss is in people with diabetes?

RD: Well, there's 37 million individuals in the United States that have diabetes and that number is growing exponentially, every year. There's 48 million people in the United States that have hearing loss. So [for] individuals with diabetes that have high blood sugar, this can damage the small blood vessels in the nerves of the inner ear. However, if you have low blood sugar over time, it can also damage how the nerve signal travels up the inner ear to your brain. In both of these sugar levels affect hearing loss and it can range from mild to severe.

RK: That's so interesting. So, it sounds like people with diabetes have hearing loss more commonly, is that right?

RD: I think that individuals with diabetes may potentially have more hearing loss, if there are any kidney issues. The kidney and the cochlea tend to have similar physiologic mechanisms involving the transport of fluids and electrolytes. I see a lot of people is one of my main questions is, "do you have diabetes?" And if you do, then I know that you have a potential, especially if you have moderate diabetes, or moderate kidney disease, you probably have a higher probability of having [hearing loss].

RK: Interesting. So, it's not only the diabetes, per se, but complications such as diabetic kidney disease that may put someone at higher risk. You mentioned that both high blood sugar and low blood sugar could impact hearing. What are some of the mechanisms or ways in which blood sugar affects hearing?

RD: Well, you can link that actually to some diets. I did some research for Brigham and Women's Hospital Study of 2018 which monitored the hearing health of more than 70,000 women on various diets over 22 years. And they found that limiting foods, like sodium - salt is very, very sensitive in the ear. There's a disease called Ménière's disease. So, we tend to put those individuals on a low-salt diet. Patients also, if they eliminate the low-density lipoproteins, they lower the cholesterol, and they tend to discourage consumption of refined and red meats to a limited amount.

RK: So, you mentioned salt intake, which is quite important to monitor, especially in people who have high blood pressure. And we know that high blood pressure goes along quite commonly with diabetes, especially Type 2 diabetes. You mentioned Ménière's disease, and I wonder if you could talk a little bit about what that is.

RD: Ménière's disease is an inner ear disease where we have an increase in the hydrops. And individuals that eat a lot of salt tend to have dizzy spells or episodes where the hearing can fluctuate. It can get better, and it can get worse. And oftentimes, patients are a little unnerved by saying that their "hearing fluctuates," or "I heard better yesterday than I hear today." But they are more apt to tell you about the dizzy spells because they are pretty incapacitating. Just like you learned in chemistry about the sodium potassium channels in which the increased amount of salt can cause issues with your balance.

RK: And what is hydrops you've mentioned?

RD: The hydrops is a fluid in the inner ear.

RK: To start with hearing loss because I know you mentioned a few things in addition to balance problems that perhaps we can get back to but just starting with hearing loss, what do we mean when we talk about hearing loss?

RD: Hearing loss often presents to family members before it presents to the patient. I tend to see patients that come in for their ringing in the ears. If they are accompanied by a family member, the person with hearing loss tends to be in denial because it's an invisible epidemic and that you can't see it. But the family members will say I need to repeat or the TV's up too loud, or we're at the table and they mishear and may interject with something that's already been discussed or reply with a comment that has nothing to do with the conversation. So usually, it's family and friends that tend to notice before the actual individual with the hearing loss.

RK: I know that hearing loss can occur more commonly with aging, as people get older. Do people with diabetes have hearing loss at earlier ages? Or what makes it different in people with diabetes?

RD: I think when you talk about diabetes affecting children, the longer you have diabetes, the data has shown that approximately one to three per thousand children have hearing loss and other studies have shown rates from two to five per thousand. I think that the duration of the disease and the degree of metabolic control as well as very strict glycemic control could potentially prevent and or delay this complication that as you age, I try to explain to patients that your ears get tired and your ears work 24/7 from the day you're born. So even when you go to sleep at night, you may hear someone snoring, you may hear the wind, you may hear the thunder, you may hear the dog, certainly an alarm potentially unless you have a high frequency hearing loss. The ears get tired. And if you have chronic ear disease, diabetes, or ototoxic exposure with different types of chemotherapy, there are medications, and you can go to the audiologyproject.com and they have a list under educational materials regarding the different medications that have hearing issues, vestibular, and balance issues. So there's a nice long list there of the different medications.

RK: It sounds like it could be very nonspecific the kinds of symptoms that you're talking about with hearing loss and perhaps even balance issues, but are there certain medications that we use for diabetes that we should be particularly aware of that could have these side effects?

RD: I know that aspirin definitely contributes to tinnitus, and a lot of patients say well, "I don't have ringing in the ears, but I hear crickets, or I hear cicadas or I hear bells and whistles and static, and wind." I've actually heard it described as "frying wires" or "roadwork off in the distance." And definitely aminoglycosides are one of the primary sources of ototoxicity as well as quite a few of the autoimmune medications that are used.

RK: We talked about hearing loss in people with diabetes. And I think many people are probably familiar with the symptoms you've described, or have at least heard of hearing loss. But I think what's not as well recognized is the balance problems, or the vestibular problems. I wonder if you could talk a little bit about how people with diabetes may have impacts in those parts of the inner ear.

RD: Individuals with hearing loss tend to fall three times more often. The inner ear has the semicircular canals, which is your balance, and then it has the cochlea, which has the hearing nerve. So if the hearing nerve is impaired, the vestibular nerve, essentially as its best friend, runs right by it. So if one is impaired, there's a higher probability that the other one would be impaired. There's definitely the potential of diabetic retinopathy and peripheral neuropathy that contributes to falls as well. There are certain risk factors that we associate with falls, [such as] vestibular disorders for balance, Vitamin D deficiency medications that are linked to treat dizziness and falls. There are medications that people take that have side effects of dizziness that could create falls, postural hypertension, vision impairment, eye disease, individuals with foot and ankle disorders, again neuropathy and home hazards, which I don't think most people even consider.

RK: That's so important to recognize and to talk about, so thank you for bringing that up. Especially as people with diabetes age, we know that older people are at higher risk for falls. But as you mentioned, there may be other reasons why people with diabetes in particular get higher risk for falls; complications such as retinopathy and neuropathy. Then the vestibular dysfunction, the inner ear dysfunction that can occur as well: off balance or feeling as if the ground is uneven. What can be done for people who have those kinds of difficulties?

RD: Well, I think some extrinsic factors: if we had more handrails on the stairs, if we had better stair design. (sometimes stairs aren't staggered properly) or if you're out on concrete perhaps you have pieces missing where people could trip and or fall. Bathroom grab bars are a big one because when an individual comes out of a shower or gets up out of the bath, you tend to have a ceramic floor, and you tend to have slips. The uneven surfaces—most people don't even consider going from carpet to wood or carpet to ceramic, but they are different, especially when you have neuropathy. There are psychoactive medications that patients need to be aware of. And then your improper use of assistive devices. So, like when I see patients with canes, they're not using them properly. Or individuals with walkers that have tennis balls on them, which if I could only create something to replace the tennis ball with—that would be something. But I think that individuals with

balance issues definitely need to have some physical therapy and proper podiatry. Another thing is just to acknowledge their age because one in four adults over the age of 65 report falling and there are 36 million falls and 37% of those require medical treatment, which is approximately \$50 billion in medical costs annually. I think patients need to be asked about their fear of falling, primary care needs to check chronic conditions, they definitely need to get their eyes checked, I would definitely observe their gait and balance problems, physical therapy, their muscle weakness. They should have some good trunk stability, which then helps the back as you age, [people] tend to loosen height and people tend to curve of the spine and they spend more time looking down instead of looking forward. I think that that also contributes.

RK: Wow, that does sound like falling has a tremendous consequence both on society and then also economically in terms of the consequences that it can have. And it was really helpful to hear you talk about factors in the environment, such as the ceramic tiles with the cracks in the floor, that little things like that could really put someone who has balance difficulties at a higher fall risk. And the chronic diseases such as diabetes, which we're focusing on today, that can especially put someone at a higher risk of falls and really needs proper attention to avoid them. How would one be diagnosed with hearing loss? What kind of tests do you do in your clinic to diagnose hearing loss?

RD: When someone comes into our clinic, they tend to be, more often than not, in denial that they have hearing issues. And they're here due to a family member that has been on their case or their spouse or child. What we do is we take a full comprehensive history. From there, we do what's called tympanometry, or emittance where we measure the ear canal volume. We measure the eardrum movement, we measure the middle ear pressure, and we want to see how that is. So that tells me the health of the outer and the middle ear. Then we go to the inner ear, and we put you in a sound booth and we'll put headsets or insert earphones into your ear canals. And we measure how you hear by sound-pure tones at each different frequency: low frequencies, mid frequencies and high frequencies. And we track how low you can hear those frequencies 50% of the time. Then we also do a speech threshold exam where we use spondee words and track how low you can go with those words. Then we do what's called a word recognition exam where we find your most comfortable level, and we present words to you and see how you do in sound-proof environment which some people tend to do quite well in a sample group. But the problem is, is that you don't live in sound-proof environment. Then an example of a quick sin where we present sentences, and with each sentence as you go down the list, background noise enters, and it gets louder and more competitive to hear the sentence and the noise. So, then we can look with comprehension, which to me, is a more realistic issue because one-on-one most patients say, "Well, I hear you quite well." And I tend to speak loudly, and I tend to speak clearly. But I am not your family. I'm not going home with you. So, it's a good example when you present the sentences for them to realize that there is a breakdown in the noise. There are problems in the car with the road noise and the turn signal and the windshield wipers and the air conditioning or the heat and the radio and then the person wants to talk to you. And you're thinking well, "Oh my god, how am I supposed to hear you over all of this noise?" Even that kind of environment is challenging. Those are the tests that we start with, and then there are other dizzy tests that they perform downtown and at other satellite offices.

RK: What you were describing with the background noise and being able to tease out sounds I think is so important because that really is how the world works, isn't it? That there's often competing noise in the background and trying to make out what someone is saying through all that can be especially difficult if you have hearing difficulties. How do you think hearing problems or balance problems impact diabetes care? How does this impact the management of someone who's trying to control their diabetes?

RD: I think that when you are diagnosed with diabetes, there's a pathway and or protocol that's followed. So immediately, you're connected to a diabetic educator. I believe there's 10 hours of diabetic education that is supposed to accompany individuals that are diagnosed with diabetes. And then the person is sort of on the list for the dentist and then they're on the list for the ophthalmology, then they're on the list for the podiatrist. And it's not just ears, teeth, and feet. It's hearing as well. And I think audiology needs to get into the protocol because if you have diabetes, couple that with potentially COPD, hypertension, and then hearing loss. It's kind of like the perfect storm that just may add into issues in the inner ear. You have that semicircular canal, if you have any retinopathy, you may have issues with a vestibular ocular reflex and your weakness in your muscles if you're not very active in your home. It just sort of adds up. And I think audiology is one of the providers that needs to be involved in that pathway protocol as one of the team members-active in the management of the patient.

RK: It certainly seems like audiology should be more a part of those protocols, especially for people who have diabetes of all ages. But especially as people with diabetes, age, mobility, the ability to function independently, and not wanting to have falls and fractures become such a priority. The comprehensive evaluation of someone and their risk factors for fall does seem to necessitate an important evaluation of audiology and the ear. At what point do you think patients, if they're concerned about this, or any of our listeners that are concerned about this who have diabetes, should come to see someone such as yourself who's an audiologist? You know, I often have patients in my clinic who say that they have difficulty hearing at times, but it's not always clear when this becomes something that warrants further evaluation. What would you say to our listeners who might be concerned?

RD: My first question that I would ask them is when was their last hearing test because normally, you're gonna get an answer, such as "I've never had a test," "I'm here for a baseline today," "when I was in elementary school..." Only 15 to 16% of primary care physicians do screening for hearing. You see a patient in their 60s or 70s, or even 80s, and they're here for the first time and they're diagnosed with hearing loss. I have no idea when that started because there's no baseline for it. I think that getting a baseline is important. If we tell you you're normal, then you certainly can come back and two years or three years unless something comes up in between and you want to be checked. But since you check your eyes every one to two years, and a lot of people tend to clean their teeth (recommended twice a year, every six months), I think hearing is something that I speak, you hear, and I assume that we're great, we're good to go. Because you know, you hear me. But like I said it's an invisible issue. I would never look at someone and say, "Oh, you know, I think you have high blood pressure" and not take a pressure reading. When you go into your primary care, they check your blood pressure they'll run different blood work on you, and then take your weight. And, you know, [it is estimated that] 41% or 41.9% of the US population [have] obesity and obesity directly correlated to diabetes, there are a lot of issues that need to be addressed. I would say if you go and you renew your driver's license, and they're checking your eyes, then I think you should have your hearing checked.

RK: For people who have diabetes, would that be covered by most insurances? Or is that something that they would have to ask to get referred to?

RD: I would definitely ask. I think insurances are changing all the time. And there are different levels in the insurance. There's PPO, POS, HMO, self pay; there's just a wide variety. And before I would do anything, I would definitely check either on the back of the card, just to call and confirm, or I would ask my primary care for referral if they're having ringing in the ears.

RK: I wonder if you could also comment briefly on diabetes-related hearing loss or hearing loss that occurs in people with diabetes and depression. Is there a link between those?

RD: There actually is a link between diabetes and depression, and I'm wondering if it also is because of hearing loss. So when you have a hearing loss, a lot of times you have a decrease in social engagement. People don't want to go out with family and friends because they sit there and they really don't know what people are saying because hearing is one aspect and understanding is another. So imagine going out to dinner and sitting with some friends, and you're not engaging, but you're laughing, but you really have no idea what people are talking about. That's not fun. It makes people feel frustrated, isolated, and lonely. As well as untreated hearing loss often can impair cognitive function, which in those individuals, we have one in five teenagers with hearing loss today. So cognitive function could lead to [poor] school performance or work performance. It also has long term side effects on your health. If you use hearing aids, there is definitely a lower prevalence of depression.

RK: I bet that connection between hearing loss and depression and particularly people in diabetes is something that we don't think about as much as we should. But perhaps in someone who has decreased social engagement or whom family members note aren't being as involved socially as they once were, perhaps hearing loss should be something to be considered. And we know that depression has far ranging effects on diabetes self-management. And so this sounds like another reason why paying attention to hearing is particularly important. And you mentioned cognitive function, too. We also know that diabetes can affect cognitive function, and then add on hearing loss to that, like you said, it just seems like unfortunately, the perfect storm. You mentioned hearing aids, and we haven't really talked about treatment, or hearing loss or balance problems. I wonder if you could talk briefly about what kind of treatments you're able to offer and how effective they are for these conditions.

RD: The options are, your hearing is normal. And then I would just use hearing protection and watch my use of the iPods and the earbuds because that seems to be a huge problem in use for people today with school and you know, they're riding their bikes, and they're jogging and they're running in their elliptic lane or they're in step class or the gym, everybody's plugged in so that's the first issue. Hearing aids- if you have a mild hearing loss, moderate hearing loss, [or] severe hearing loss, we would like you to get hearing aids. A lot of people would say, "Oh, can I just hear from one ear?" And you know, one hearing aid is better than no hearing aids. However, you would never go to the eye doctor and say, you know, "My left eye doesn't need to see... I'll just do the right lens" because your depth perception would be off. Same thing for hearing. If you have hearing loss in both ears and if you have coverage, you're capable of paying for these miniature computers that go on your ears. Your auditory perception is also very important, and we don't want that to be off balance, so to speak. Hearing aids do not fix, they do not cure, they do not restore, they do not repair; they aid. So, you have to make sure that there are realistic expectations with understanding, which is why we do those word tests to see how you do in a booth. And then how you do with that background noise. Which is interesting, because if you're born with hearing, you hear everything because you can't turn your ears off. So, because you have to hear it, you filter. You filter it out. You filter out the light sounds, the clock ticking, the dog's nails on the floor,

sometimes you filter people out and then over time, it's really progressive and insidious, you slowly stop hearing these things. So, when you put hearing devices on individuals, and they say, "Oh my God, I've never heard like this before." Well, it's not new noise. It's just the noise you haven't heard because there's no new creation of noise that's happening. You just need to use your hearing aids [and] get used to hearing because the more you use them, the easier it will be to get accustomed to filtering out those sounds again.

RK: What you said about filtering sounds and noises, no pun intended, rings true. I think we can all relate to that; filtering out what someone is saying non-intentionally necessarily, just like you said, there are so many noises in the environment, and it seems like when you have hearing loss though that could potentially be to your disadvantage if you're trying to really pick up on sounds. The hearing aids that you mentioned, are there special hearing aids for people with diabetes, or are they the same hearing aids that are offered to everyone?

RD: There are different manufacturers and there are different styles. There are hearing aids that can go in your ear of varying sizes from filling up the ear to something very small. But you have to look at the hearing loss, how much power you need to put in the device, how much power the patient requires. As well as the size of the patient's ear. So, if they have this very large hearing loss and their ears aren't the size of John Wayne, there's a good chance you might not be able to fit it all in. In that case, if they have a pretty substantial hearing loss, you may need more power, and you may be limited in the ones that go in the ear. So, there are behind the ear hearing aids that can offer sound at a much higher level, and we do custom earmolds. There's also a product on the market called the Receiver-In-Canal product and that's where we have this thin tube receiver that goes in the ear. We call it an open fit where natural sound can filter into the ear now, and then mix in with the mechanical sound of the hearing aid, giving the patient the best sound quality. There are other products that are extended-wear products that are deep down four millimeters from the eardrum. Individuals say they want to hear but sometimes they only want to hear what they want to hear. So some people are not very happy with the 24/7 option. It really does depend upon the patient, their dexterity, their willingness to really give it a try, the family members support, the proper prescription for the hearing loss, and then of course, if they're not a candidate for hearing aid, there may be an option like the cochlear implant, or there are other implantable devices for other types of hearing loss. So, there's a wide variety of options. We just have to get people to take that first step to try it.

RK: I've heard about cochlear implants. Could you talk a little bit more about what those are?

RD: Cochlear implants are devices that are surgically implanted that deliver sound electrically. I'm talking to you right now acoustically. I'm not talking to you electrically. It picks up sound and it electrically stimulates the eighth cranial nerve. And there are different protocols and formulas that are utilized to decide whether a patient is a candidate or is not a candidate. Oftentimes, it's a level of discrimination ability or inability to use amplification. If you have very poor understanding, amplify gobbledygook, and you make it louder gobbledygook, the patient is not going to be real happy with that, especially if they spent a lot of money -thousands of dollars. So it really depends upon the patient. Some people don't want surgery, hearing aids will provide balance, localization, environmental and safety cues perhaps, potentially not understanding in those severely profound cases.

RK: These devices that you mentioned, the hearing aids and the cochlear implant, if I'm understanding correctly, sound like they can really help with hearing sounds but do they also help with balance? Pr what can help those people who are having problems with balance as well, the vestibular dysfunction that we talked about?

RD: I think individuals with vestibular dysfunction, most certainly need to have vestibular work. There is a protocol for patients that are off-balance because if you break a hip, there is a probability and/or chance that you will be in a rehab. And from the rehab, given what's going on at home, if you have stairs, you may not be able to return home and live independently, which is a very big thing for any individual. They don't want to live anywhere but their home. As for devices for vestibular issues, I think one of the biggest, helpful protocols that you can use, would be your physical therapists to work on trunk stability and the different varying surfaces and the lower leg strain. For eyes, I think getting the proper prescription, so you're seeing properly. For your ears, getting the proper prescriptions and your hearing better, the localization ability, the auditory cues; if you're missing auditory cues, and you're missing visual cues and you add neuropathy into that, it can be a very dangerous situation.

RK: Well, that's helpful to know. It sounds like for the balance and the vestibular issues; it really has to be kind of more comprehensive in terms of targeting the different aspects or different deficiencies that could impact balance. People who have hearing problems or balance problems that successfully undergo these interventions and have improvement in their hearing and vestibular balance, have there been studies that have looked at whether their diabetes management also improved?

RD: Quality of life, they're more active and social. They may want to go to the gym, they may eat better. I don't know of any particular studies, but I think that hearing better and enjoying your life is important.

RK: Then in terms of glycemic management, you mentioned that high blood sugars and low blood sugars can impact hearing. Do you think that getting people closer to their glycemic target has benefits for hearing or what would you tell people?

RD: Because diabetes is correlated to obesity, which is at least 41.9% of the US population with the other comorbidities. I think the A1C monitoring needs to be at least twice year. I think checking in with that diabetic educator is essential, more often once a month to maintain better control of the disease [and] better control of the weight. I think having somebody held accountable is very important. A lot of people when they're not held accountable tend to sort of slide off the rails a little bit and it's not on purpose. It just happens; life happens. I think better control of food intake, the size portions, the diabetic educator involvement, the more monitoring of the A1C, better involvement from the primary care, and a collaborative effort amongst the specialties - instead of just having hearing, vision, podiatry, primary care, nephrology, endocrinology. Maybe there's a way or collaborative way, especially with Zoom now, where maybe once a year, the specialties could kind of get together to manage the patient as a whole person instead of parts. I talked to you, you keep me updated, the diabetic educator jumps in, maybe the primary care says, "Well, I haven't even seen them, so I don't know their blood sugar." If we can communicate with one another about the individual, I think that would be more helpful for them as well.

RK: I fully agree getting everyone to interact and cooperate and coordinate care is definitely the ultimate goal that we could probably all work towards even more. In regards to diabetes management and I was focusing on the glucose particularly, I was just curious if there were any examples from patients that you might have seen with diabetes who upon having their hearing improved, or their balance improved, noticed some benefits in their day-to-day health. I wonder if there's any examples that you might be able to share.

RD: Well, I know for sure that definitely decreasing salt is positive, not always easy, doesn't make things taste very well. I would say just add more pepper. But it definitely does help. As for making the hearing better, once you have nerve damage, you sadly, I haven't seen them repair nerves. You can transplant organs, fix muscles, tendons, even bones, but I don't see nerves being treated other than through the cochlear implant. Other than that, once there's a hearing loss, whether it's over toxic, noise-related, chronic disease-related, multiple different venues affecting the hearing, which some people don't even think about. For example, a dentist with a drill is going to have a hearing loss. Hairdresser using hairdryer blowing hair straight all day long is noise exposure. These little things that people take for granted, you know, they would go for a bike ride, and they ride their bike for 45 minutes and their ears are plugged in with sound and they're in the groove, that's noise exposure. You're mowing the lawn. It's noise exposure. Constantly overwhelmed. But as for making your hearing better, not really, because it's a nerve.

RK: It sounds like that once hearing loss has occurred. It really can't be reversed.

RD: Yes

RK: But perhaps prevention is where we should be focusing our efforts. I wonder if you might have some parting words for our listeners who are concerned about losing hearing, losing their balance, and have diabetes. What can they do now to optimally preserve their hearing, their balance, and to prevent hearing loss in the future?

RD: Noise protection is key and there are different filter levels that you can put into custom noise protection, hearing protection, ear savers, that's for sure. You want to protect your hearing as much as possible if you can with the environments that you're in and the activities you're doing. If you have balance issues, that is something that I would definitely address to your primary care. Automatically, there should be an audiology referral sent out. If they are dizzy, they will see the audiologist, they will see ENT, and they will follow the protocol for the vestibular evaluation. Given that diagnosis, physical therapy will probably get involved to try to control the balance issues. I think podiatry with footwear is going to be important to make sure the patient is in the proper shoes. And I would definitely get your hearing tested especially if you haven't had it tested because you assume you're hearing but no one really knows. The audiologyproject.com has a plethora of information and educational materials as well as each state as a diabetic cohort that they can reach out to, to discuss any issues with regards to hearing, balance, diabetes.

RK: Dr. Dinkes, thank you so much for being on our podcast today and sharing your expertise. I know that I've learned a lot and I'm sure our listeners have learned a lot.

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. For more information, visit hopkinsdiabetesinfo.org.

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