Seizing Life, episode 47
All About Seizures: How Understanding Informs Treatment
Guest: Dr. Michael Smith
(Transcript)

Kelly Cervantes:	00:00	Hi, I'm Kelly Cervantes and this is Seizing Life, a biweekly podcast produced by Citizens United for Research in Epilepsy, CURE.
Kelly Cervantes:	00:19	Today I'm happy to welcome Dr. Michael Smith to another remotely recorded episode of the podcast. Dr. Smith is the director of the Rush Epilepsy Center, professor in the Department of Neurological Sciences and Senior Attending Neurologist at Rush University Medical Center in Chicago. He is a longtime friend and supporter of Cure having served as the founding board chair, and he was instrumental in helping Cure set up its research program. Dr. Smith is joining us today to talk about categories and types of seizures, how they may present in epilepsy patients and how categorization of seizures can help doctors in prescribing treatments.
Kelly Cervantes:	00:58	Dr. Smith, thank you so much for joining us today. I know you're incredibly busy, so we really do appreciate you taking time to educate us. I know that the definition of a seizure is sort of evolving and changing as we learn more. What is that scientific definition of a seizure?
Dr. Michael Smith:	01:21	The idea that an electrical disturbance that disturbs or interferes with normal brain function would probably be a basic definition of a seizure. And that electrical disturbances is the short circuit.
Kelly Cervantes:	01:37	What is it that's happening in the brain when a seizure occurs?
Dr. Michael Smith:	01:41	Okay, that's a great question. So the brain is an electrical organ and you could sort of think of it as there's a short circuit in one area of the brain. And if you put it sort of in computer terms, you could think of the brain as a network of computers. And you could think that one of the... A focal seizure a is a as a short circuit in one of the computers of the network, while a generalized seizure is a short circuit in the entire network. The disturbance of the behavior depends on where that short circuit occurs.
Kelly Cervantes:	02:18	Okay. You mentioned generalized and focal seizures. What are they? What's the difference?
Dr. Michael Smith:	02:28	So with our newest definitions of epilepsy, we talk about focal seizures that begin... So they're beginning in one spot with or without changes of awareness. So a focal aware seizure, that

means that a seizure is occurring in one spot of the brain, and I'm aware of it. And I can tell you later that "My... Well, my hand was tingling" or "My hand was twitching." While focal, not aware or with awareness impaired, you're not going to be able to remember that your hand was twitching or tingling, and you wouldn't be able to report that. Now the other big division in seizures is with or without motor activity. So they're going to be an aware of seizure with motor activity or an aware seizure without motor activity. So we divide all of the epilepsies, the part of the partial epilepsies into again, focal or partial with, or without awareness, and with or without motor involvement. And then the generalized seizures are occurring throughout the whole brain. And there again, with motor activity, without motor activity, and with awareness and without awareness.

Kelly Cervantes: 03:44 So what you're saying, is there are a crap load of different types of seizures?

Dr. Michael Smith: 03:48 That's correct.

Kelly Cervantes: 03:50 In a very lay term, we've got a lot of different kinds of seizures going on. And I think that that is so important for people outside of the epilepsy community to really understand because I think they think of movie style seizures as what they are, and sort of understanding that there is a larger array of what seizures can look like for people.

Dr. Michael Smith: 04:15 Exactly. Exactly.

Kelly Cervantes: 04:16 So within these two seizure categories, we have focal, we have general generalized, and then you talked about whether they were aware or not. Can you sort of explain the names of those seizures? Because once again, I know that they've recently changed a lot of the names and sort of what those are, and are you able to know where they're occurring in the brain? How does that work?

Dr. Michael Smith: 04:44 Yeah. So the names are just that focal and then impaired awareness or not impaired awareness, with motor or without motor. Those are the names now. The description of the seizure is all important because that tells you exactly where the seizures are coming from. So if someone tells me that they have a visual hallucination onto the right side of their world, then I can say that there are seizures that are coming from the left posterior head region in the temporal occipital area. So you can... So history is all important in defining where the seizures are coming from. It's better than any of our other testing. It's better than EEG. It's better than any of our testing is, is the

history from the patient, and the description when the patient can't remember the seizure, the description of the seizure from the witness.

Dr. Michael Smith: 05:34 So the patient might say, "I felt a funny... I had a funny feeling in my stomach. And then I lost awareness." And the witness will say, "I went up and talked to them and they were mumbling and then picking at their clothes and swallowing, and then they turned their head to the right and fell to the ground and had a convulsion." And so that would tell you the whole sequence of events that occurred as the seizure spread from a focal aware seizure, to a focal unaware seizure within secondary generalization.

Kelly Cervantes: 06:06 So that sort of helps because clearly if you have a patient who is nonverbal, they're not going to be able to tell you about the feeling in their stomach or tingling in their hand. But eye-witnessing the seizure. You can potentially have a better idea of where that might be occurring in the brain.

Dr. Michael Smith: 06:26 Exactly. That's exactly it.

Kelly Cervantes: 06:29 It's so fascinating to know that so much can be learned just visually from someone who has a trained eye on what to look for.

Dr. Michael Smith: 06:41 And what I tell my residents and fellows is, if you're in doubt of what's going on, you talk to the patient because they can often tell you what's happening by their description of their event.

Brandon: 06:54 Hi, this is Brandon from Citizens United for Research in Epilepsy, or CURE. For the 65 million people worldwide living with epilepsy progress is unacceptably slow. At CURE our mission is to find a cure for epilepsy by promoting and funding patient focused research. Learn more at cure epilepsy dot org. Now, back to this episode of seizing life.

Kelly Cervantes: 07:16 We hear some of these terms, tonic, tonic clonic, absence. Where do they fall in? Do we still call them that? Or have they changed their names too?

Dr. Michael Smith: 07:26 No, no, no. So, the tonic and tonic clonic are descriptions of the motor phenomenon. That's all. And so you can have... When a muscle, when an extremity just stiffens and then is held there, that's called tonic. Clonic is when it starts to jerk, and absence seizure is that is the generalized non unaware seizure. And

that's where someone would just stare off and be gone for 15 seconds and then suddenly come back.

Kelly Cervantes: 08:00 What other seizure types should we know about? What other names?

Dr. Michael Smith: 08:06 So, the major seizure type in an adult is a focal seizure with impaired awareness. And that seizure usually involves the temporal lobe. And it usually... The impaired awareness means that the memory circuit is involved deep in the temporal lobe. So the person is no longer remembering what is going on. And so this... When a seizure switched from impaired or from non impaired to impaired, it usually means that that memory circuit is being engaged in the seizure. And so a seizure is spreading from one area into another.

Kelly Cervantes: 08:45 So a seizure can start out as focal and then become generalized?

Dr. Michael Smith: 08:50 It can. A lot of seizures do that. So they start out as a focal seizure, and it could actually start as a focal.... A simple partial, or a focal aware seizure going on to a complex partial or a focal unaware seizure, and then going on to a generalized tonic clonic seizure, or a generalized convulsive seizure.

Kelly Cervantes: 09:12 So you'd say that that's the most common seizure type in adults. What about in children?

Dr. Michael Smith: 09:17 So in children, more of the generalized seizures are occurring. And some of the more harder to describe seizures are occurring. Absence, it used to be called petite mall, or absence is a childhood epilepsy. Some of the partial motor seizures are more common in the pediatric population. So the adult populations, their brain is more mature. And there's fewer ways for a seizure to manifest itself through a... While in a pediatric patient there's more manifestation. So in the neonate, in the brand new baby who has having seizures, they can be very odd and subtle seizures that again... And sometimes just fragments of seizures, just because of the maturity of the brain at that point in time.

Kelly Cervantes: 10:12 Where does infantile spasms fit in to that? [crosstalk 00:10:16]

Dr. Michael Smith: 10:17 Okay so, infantile spasms that's a great question because that's one of those seizures that is... It can be quite subtle, and sometimes it can be not so subtle, but it can go ahead anywhere from a little head drop to some rolling of the shoulders to almost a spitting up like a big fluxion of the waste. And so it has

many manifestations. And its manifestations... So infantile spasms sort of disappears as the child matures, and it sort of evolves into other seizure types. So the child with infantile spasm sort of graduates into a Lennox Gusto like pattern with multiple different seizure types as the central nervous system matures, and as different tracks of the brain are myelinated. So they're being wired. You could think of impetus spasm as... Really it's... The manifestations are due to, in one sense, to the immature central nervous system.

Kelly Cervantes: 11:25 Are there certain types of seizures that are easier to diagnose via EEG or visuals and others that are more challenging?

Dr. Michael Smith: 11:37 Oh, absolutely. No matter how hard to watch a generalized tonic clonic seizure, I would actually prefer if everyone's started their seizures like that. Because what happens is that then that grabs attention, right? It's a dramatic event that will ensure people will go and see someone and get a diagnosis. While... So, people can have years of very subtle seizures that be harming the brain in a subtle sort of way, but in a continued sort of way, without a diagnosis. So many people have... When they had their first convulsion and you talk to them while they've been having funny smells for a long period of time, and all those funny spells were actually seizures. And all those funny spells that they didn't know what they were was strengthening that circuit over time. So making it harder and harder to treat.

Dr. Michael Smith: 12:35 So I would just as soon have everyone declare themselves as having epilepsy and then coming and under treatment, 'cause then I have a better chance of getting them into a medical remission. And if I get them in medical remission, then I have a better chance of disease remission. So my goal is always no seizures and no side effects on medication first. With the idea that then in some of those, I can go to no seizures, no side effects, off medication,

Kelly Cervantes: 13:04 You bring up something that I don't think a lot of folks are aware of, which is that the faster that you treat... The faster you can get a diagnosis, the better chance you have of getting the seizures under control. And so to pay attention to those funny spells or to not ignore it and get to a doctor and make sure that you're talking about it.

Dr. Michael Smith: 13:33 Well, the big problem, the brain doesn't discriminate learning good things or bad things it learns. And what actually is happening, it's learning seizures. And so the longer you have seizures, the better learned it is. And so once something is better or learned, it's harder to get rid of. It's like a memory that

you go over on again and again and again, and it's harder to forget that memory then. So there's no question that the best chance of getting someone into disease remission is a early rapid diagnosis and then rapid control. And the longer they have uncontrolled seizures or untreated seizures, the less chance of me ever getting them into disease remission. But those spells count too. For instance, I care for a family practitioner who during her medical school days began hearing an advertising jingle in her head.

Dr. Michael Smith: 14:33 And after a while it bugged her and she got herself evaluated and everything was normal. But it continued. It would be brief lasting 15 to 30 seconds, and never any loss of consciousness, happened a couple of times a month. And this continued. So then while she was a resident, she would have that followed by vertigo, dizziness that where the whole room would spin. And again, she had herself evaluated, everything was normal. Now this had been going on for about 10 years, then one day at a movie theater, she had advertising jingle, vertigo, and then a convulsion. And so she had been having small seizures this whole time that were unrecognized. And so then me trying to treat her, I was able to get her seizures under control, but she will never be able to go off medication because that was a well learned phenomenon. And again, the brain's a learning machine, it just learns. And it doesn't know not to learn certain things.

Kelly Cervantes: 15:34 That's just wild to me that a, a seizure can manifest in that way. And it's so interesting to think about the brain in that way. And that it just, it learns good or bad.

Dr. Michael Smith: 15:50 Yes, it learns.

Kelly Cervantes: 15:51 You're right.

Dr. Michael Smith: 15:53 That's what it's good for.

Kelly Cervantes: 15:54 Yeah. So I guess, to that extent, are there some seizures that do more damage than others?

Dr. Michael Smith: 16:02 Well, that's a really good question. It appears that some of them don't activate the brain in the same way. So absence seizures seem to be... It might be a seizure of the inhibitory system, not the excitatory system. And so they don't seem to cause the same longterm damage that the excitatory seizures can. And excitatory seizures in certain structures is more damaging than in other areas.

Kelly Cervantes:	16:36	Explain the difference between an excitatory seizure and a... What was the other one again?
Dr. Michael Smith:	16:40	Inhibitory. So the brain has... It's a positive and negative. So there's a... In effect. There's excitatory is where the system is very [inaudible 00:16:54]. But we also have a system that sort of holds the brain in check. That's the inhibitory system. And a lot of our medications that we use are acting on the inhibitory system to improve it. So the benzodiazepines like Clobazam, like Valium are actually improving the inhibitory system and that's how they act. And so it may be that some seizures don't cause the same damage... And damage in certain locations. So again, the biggest complaint that my patients have is that they can't remember. Well, their short term memory is not good. And that's usually because that short term memory hard drive is involved in their seizure.
Dr. Michael Smith:	17:47	And what actually happens over time is their short term memory gets damaged and you can actually see chain over time, you could see it shrink. And you can actually see loss of brain volume in that circuit that correlates with their decreased memory function. And so that's a direct relationship between the number of seizures and the severity of the seizures and the loss of brain volume, brain structure.
Kelly Cervantes:	18:19	When you are... So you're diagnosing a patient and you are figuring out their seizure type along this train of thought. I imagine that that then helps you decide which medication is going to be the best to treat those. Can you sort of explain a little more in depth, how someone's seizures might determine the best treatment for them?
Dr. Michael Smith:	18:42	So there's medications that are good for all seizures, but most of our medications are either good for those focal seizures or the generalized seizures. So knowing what seizure type you have helps dictate which medications that you can use. Now, the good news is that in the past 20 years, we've now developed more medications that are good for both the generalized and the focal seizure. So, the only one we had in the way past in the nineties, early nineties, was by valproics, or valproic acid that was good for both seizure types. But now many of our medications are good for both seizure types.
Kelly Cervantes:	19:28	We obviously know that there are other ways to treat seizures aside from medication, VNS, or surgery, or the brain implants. What seizure types work with those and how...?

Dr. Michael Smith:	19:43	Yeah. Those are good questions. So the bottom line is, is that we always try medications first, right? And about two thirds of people will respond to a medication the first or the second medication. Now, if that fails, then you say, "Okay, how can I cure the patient?" So if all the seizures are coming from one spot, that's when you start to say, "If there's a scar in that one spot. So there's the MRI scans abnormal in that one spot, the EEG is abnormal in that one spot. So if I can get rid of that one spot, then I could successfully cure the patient." And those are the people that you say, "I could get rid of that spot by taking it out." I can resect it, remove it, or now more recently they have laser ablation where I can destroy that one spot and therefore, stop the seizures.
Dr. Michael Smith:	20:38	And so what if you say, "My medicines aren't working." The next question is, "Are all your seizures coming from one spot?" If they're more than one spot, then resective surgery, or taking a spot out, or destroying a spot wouldn't help. So then you're saying, "Okay." Then you're thinking about neuromodulation, which is the vagal nerve stimulator, but now there's also the deep brain stimulation and responsive neurostimulation. So then we now have three different stimulations. And the other treatment... The option for the person who has seizures coming from more than one spot is a diet. We know that diet works and diet works as well as our medications in some individuals, sometimes even better.
Kelly Cervantes:	21:27	So if the seizures are focal, if you can pinpoint where they are coming from, why not try surgery before medication? Or why not try the diet before the medicine?
Dr. Michael Smith:	21:41	Those are both good questions. The problem of course, is that it all depends on what that one spot does. So if that one spot is close to the language cortex or motor cortex, then yes, I could get rid of your seizures, but I'm going to leave you with a deficit that is unacceptable, right? And so that's why, the medications, presumably they're not permanent, and they're not going to leave you with a permanent deficit. So that's why the idea is, is that you first try medications. And again, two thirds of people will respond to their first or second medication. And then those are the people that the seizures get controlled. And then hopefully you can then ultimately go down on the medications and then they're in disease remission. But if the [inaudible 00:22:33] continue, you say, "Okay. Now one or two medications ain't going to work." So then I have to look at what else can I do?

Kelly Cervantes:	22:42	So you have... Just sort of had my own little light bulb moment here where... 'Cause I've always wondered, you know, they talk about people coming off of medication and I never quite understood how someone could come off medication. But in the way that you explained it, if you are training... You're essentially training the brain through the medication, not to have the seizures. So then the lack of seizures becomes the learned behavior of the brain. Is that how that works?
Dr. Michael Smith:	23:11	Well, you sort of. You know what I mean? So the bottom line is... No, you're correct. The bottom line is, is that we have a powerful system in our brains that we all would have seizures without this powerful system. And it's only when that system is overwhelmed that you have a seizure. So that's why the people that have seizures, have epilepsy, they could have it when they have a fever from another source or they might have it when they're sleep deprived, or they're under stress or they... So that's when their own system is not working as well as it was. So what is happening when you put someone on medication, they go seizure free, then you're giving their system time to sort of strengthen. And now their own system can hold the short circuit in check without the help of medication.
Dr. Michael Smith:	23:57	And those are the people that go into disease remission. Does that mean that they can never have another seizure? Not really. So if you weaken their system suddenly, they might have that seizure that they hadn't had for 30 or 40 years because it sort of came back out. Their inhibitory systems couldn't control it anymore. But you're right that the stronger that inhibitory system gets, the inhibitory system is sort of learning how to control the seizure.
Kelly Cervantes:	24:27	So you just did a really good job of leading me into my next question, which is, the truth of the matter is outside of limited surgery, there is no cure. And you know, that is one thing that the CURE as an organization is out there trying to remedy by funding research. I know it's something that I've noticed, but why is it that certain types of seizures or certain types of epilepsy seem to be studied more than others?
Dr. Michael Smith:	25:02	Maybe because they're easier to study?
Kelly Cervantes:	25:05	And what would make a seizure or a particular disorder easier to study?
Dr. Michael Smith:	25:10	If it [inaudible 00:00:25:10], or there's a better model for that seizure.

Kelly Cervantes: 25:17 You're talking about like an animal model that they [crosstalk 00:25:20] zebrafish or whatever that they can [inaudible 00:25:22].

Dr. Michael Smith: 25:24 Exactly. So I have a given genetic abnormality and then I could give that genetic abnormality to an animal, a rat or a mouse, and then you have a better model for what you're trying to study and what you're trying to treat. Remember, the problem is a lot of our medications came out of trial and error. And they came out of just being lucky, the right place, the right time, and making that observation. And so now as we start to understand more of the basics of the seizure, we can develop and understand better models. And that's what all the genetics has done. You know, we're now getting down to a genetic abnormality that then produces a seizure down the line, and then I could study how it changes over time.

Kelly Cervantes: 26:20 That makes so much sense. And then, I guess as someone who has spent his career studying the brain and epilepsy, is there something you wish that the epilepsy community understood better as a whole? And is there something that you wish that the general public understood more about epilepsy?

Dr. Michael Smith: 26:38 Well, there's two things. I think that the epilepsy, the seizures, is only one part of the epilepsy. The other part of epilepsy is the effect of the epilepsy on the brain itself. So, the cognitive psychological psychiatric changes that occur in them. And the other thing is the psychosocial sphere is, what that epilepsy does to the person and their family and their environment. And so the... You know, sometimes I think that the seizure is the smallest part of the problem. That if I could get to the loneliness, the depression, the feeling different, and sort of the stigma of epilepsy better controlled that the person's life would be better. Despite how enlightened we think we are, if someone has a convulsion in the midst of us, we will treat that person differently even if we try not to, because it scares the bejesus out of us.

Dr. Michael Smith: 27:50 And when something scares you and you don't understand it, what you do is you try to keep yourself distant from it. And so, sometimes I think if that could be broken down, so if a psychosocial aspect of stigma of epilepsy, if that could be helped, there would be the... The person's quality of life, even if they still had some seizures would be better and their life would go on better. And I think that the nice thing from a clinician standpoint or someone who's been involved in epilepsy for a long time, is you have a lot of... Treatment of the seizure is just again, part of the things that you can do. You can also educate

the public and you can educate the patient and their family to understand this whole phenomenon better and not be so scared of it. It's that psychosocial stigma, which is so hard.

Kelly Cervantes: 28:48 I think it's just so important that you bring that up. I never cease to walk away from one of these conversations. I always feel like I have a very solid understanding. And then I walk into a conversation with a doctor like yourself and am blown away by how much more there is still to learn. Thank you so, so much for your time today. I really appreciate it.

Dr. Michael Smith: 29:10 My pleasure. Thanks.

Kelly Cervantes: 29:15 Thank you, Dr. Smith for providing us with a better understanding of the various types of seizures and explaining how identifying and categorizing them can result in more effective treatments. Research has helped us gain a better understanding of seizures and has led us to developing more effective treatments, and it's research that will lead us to our ultimate goal of finding a cure for epilepsy. To help us realize that goal, please visit cure epilepsy dot org forward slash donate. Your support and generosity are greatly appreciated. Thank you.

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