Mayo Clinic Q&A - Dr. Benjamin Brinkmann - Seizure forecasti...

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SPEAKERS

Dr. Benjamin Brinkmann, Dr. Halena Gazelka, Narrator

N **Narrator** 00:01

Coming up on Mayo Clinic Q&A,

D **Dr. Benjamin Brinkmann** 00:03

One of the most disabling aspects of seizures is the unpredictability.

N **Narrator** 00:08

Epileptic seizures are a central nervous system disorder in which brain activity becomes abnormal, causing periods of unusual behavior, sensations, and sometimes loss of awareness. Today we'll discuss how a new technology could forecast a seizure before it affects an individual, allowing for better treatment and possibly even prevention.

D **Dr. Halena Gazelka** 00:27

Welcome, everyone to Mayo Clinic Q&A. I'm your host, Dr. Halena Gazelka. And do I have a fascinating topic for you today. We're going to talk about seizures or epilepsy. Despite treatments that include medication, surgery, and neurostimulation devices, many people with epilepsy continue to have seizures. The uncertainty of it, and when a seizure may come up affects their quality of life. But what if the patients could anticipate the seizure and take action? A recent Mayo Clinic study tested a technology to do just that. And I have Dr. Benjamin Brinkmann, an epilepsy scientist at Mayo Clinic here to discuss it with me today. He's the senior author on the study. Welcome, Ben.

D Dr. Benjamin Brinkmann 01:11

Dr. Benjamin Brinkmann 01:11

Hi, Halena. Thanks for having me today.

Dr. Halena Gazelka 01:13

I'm so excited that you're here because I find this just fascinating. I'm kind of an addict of my Apple watch. And so, any new technology that you can figure out things from the body through your wrist, I think that's amazing.

Dr. Benjamin Brinkmann 01:26

It is amazing. It is amazing how things are progressing these days.

Dr. Halena Gazelka 01:32

Ben, what made you interested in studying this topic?

Dr. Benjamin Brinkmann 01:37

One of the most disabling aspects of seizures is the unpredictability. That's a fairly consistent finding in studies. Patients tell us that, and surveys tell us that. And so, it's been a very interesting topic. I think for many years, there's been quite a bit of work that's been done towards forecasting seizures with invasive devices. These are typically neuro stimulators that are implanted in the brain reading brainwaves directly from brain tissue. And those approaches have been fairly successful. There are a couple challenges, I think, with those approaches. First of all, there's not currently a device that's routinely available and FDA approved that can do this. And that's something that we're very interested in and working on. And of course, not everyone wants to have an invasive device, and it's not really appropriate for everyone.

Dr. Halena Gazelka 02:34

Ben, can you tell me what is the difference between, when do you use the word seizure, and when do you use the word epilepsy?

Dr. Benjamin Brinkmann 02:41

A seizure is a single event. Actually many of us in our lifetimes may have a seizure. They can be provoked by many different things, if your blood glucose drops, if you have a head trauma, sometimes you can have a single seizure and never have another one. We don't call that epilepsy. Epilepsy is consistent or repetitive unprovoked seizures happening unexpectedly. So, if there's a provoking factor for a seizure, we wouldn't call that epilepsy.

Dr. Halena Gazelka 03:17

Okay. So, Ben you have used the analogy of a weather forecast and how that helps us predict our behavior. Tell us how that relates to seizures.

Dr. Benjamin Brinkmann 03:29

Yeah, well just like a weather forecast, they don't always get it right. Or there can be things that change the weather forecast. Seizure forecasting, also it's never exactly perfect. What we think we're doing with these devices is identifying maybe a seizure prone state in the brain and, you know, looking at whether it's EEG, brainwaves, or some other physiological parameter, we think, that's what we're measuring. Obviously, you can, a person's brain can be in a seizure permissive or seizure prone state and not have a seizure. That's certainly possible. And then sometimes maybe that state comes on quickly or, you know, the forecast misses it for whatever reason. So, it's a probabilistic forecast. You know, we think we're going to get it right most of the time, but not always.

Dr. Halena Gazelka 04:24

Interesting. So, you know, as a physician I'm familiar with EEGs, or reading brainwaves to determine seizures. But how does a device worn on the wrist assist with this?

Dr. Benjamin Brinkmann 04:36

So, certainly it is a little more challenging, we think, to predict seizures from a wrist worn device. Epilepsy is a brain disease. And obviously, if you're measuring the brain directly, it makes sense that you're probably going to do better. However, the brain is highly interconnected. It affects every system in your body. So, if something changes in your brain, it does sort of make sense that you might see some changes, subtle changes, elsewhere in your body. And we're looking at skin conductance, very subtle things that change about your your body, your heart rate, and we're looking at fairly subtle changes.

Dr. Halena Gazelka 05:18

Interesting. So, what did the results of your study show when you've trialed these?

Dr. Benjamin Brinkmann 05:23

Well, we found that, it was a small cohort, and in five of the six patients that we studied, we were able to predict their seizures better than a random predictor, which tells us that there is a signal there. We were able to accurately predict two thirds of their seizures, which means we missed a third of them. Again, there's quite a bit of engineering work yet to be done. We need to fine tune the algorithms. This was a proof of concept study, and it's exciting because we weren't sure if there was a signal there, something that we could work with. And I think the conclusion is that there is something there. We can work with this. It is quite a ways away from

being routinely available. I think that's an important point to remember. And there's a lot of engineering and a lot of improvement to what we're doing that's needed before it would really be helpful to someone.

D **Dr. Halena Gazelka** 06:18

What are the next steps in research like, Ben, before it becomes available to patients?

D **Dr. Benjamin Brinkmann** 06:25

The next steps, we are putting in for funding to do a larger study, and just spend some time and effort improving our algorithms. You know, one of the things in this new era that we live in with AI and machine learning is that data is king. We really need to collect lots of data. So, we can train our algorithms to find these subtle signals. And so, that's something we're embarking on now. You know, before it would be routinely available for people with epilepsy, we need to do a few more studies to show that it works. And I think we'd have to find a, you know, I guess a corporate partner, who would be interested in marketing this and taking it through the FDA and getting approval for it. That all takes quite a bit of time. So, you know, I just want to make the point that while we're very excited about these initial results, you know, it'll take quite a bit of time before this is available.

D **Dr. Halena Gazelka** 07:24

And you must be inspired to work on something so long as this. How do you foresee this being helpful to patients with their quality of life who have epilepsy?

D **Dr. Benjamin Brinkmann** 07:37

Yeah, there are a number of ways. The first, and I guess maybe the most obvious way that it could be helpful is if you get a seizure warning, or you have some idea that you're probably going to have a seizure at a certain time. You can rearrange your activities. You can avoid public situations, obviously, if someone gives public speeches sometimes or, you know, just has to interact with clients. Those types of things where it would be embarrassing to have a seizure in front of someone, you can avoid that. You can rearrange your schedule a bit. And that could be tremendously helpful and empowering to people. We're also very interested, I think, in ways of preventing seizures. If you know a seizure is coming, you could take a fast-acting medication perhaps. And of course, if we get the timing right and the dosage right, maybe that would prevent the seizure from happening at all. That would be wonderful if we could build that capability. In addition, some people have, for example, a vagus nerve stimulator, a neuromodulation device. And on many of those devices, it's possible to turn up the stimulation temporarily. And again, with appropriate consultation with a neurologist that might be an appropriate thing for someone to do in those situations. And it might prevent a seizure.

D **Dr. Halena Gazelka** 08:54

As a physician, Ben, I was thinking of the value of knowing how frequently someone was having

As a physician, Ben, I was thinking of the value of knowing how frequently someone was having seizures, like you said, so that you could try to prevent them by either changing their medications or changing their treatment regimen in some way.

Dr. Benjamin Brinkmann 09:09

Absolutely, absolutely. And that's another area that we're very interested in. Apart from the forecasting, detection of seizures using these devices, it's surprisingly valuable. Many people who have epilepsy, the seizures impact the memory areas of their brain, and they simply don't remember their seizures. So, for a physician that can be very challenging. It's hard to know how many seizures a patient is having, do I increase the medication, do I not? And we hope that these devices will also help in that area, that we'll be able to give physicians an objective record of how many seizures this person had, you know, in the past month, for example.

Dr. Halena Gazelka 09:47

Well, I'm so glad that you're working on this, Ben.

Dr. Benjamin Brinkmann 09:50

Thank you. Thank you. It's exciting work, but it's a privilege to be involved.

Dr. Halena Gazelka 09:54

Yes. And thank you for being here today to tell us about your work.

Dr. Benjamin Brinkmann 09:58

Well, my pleasure. Thank you for having me. It was fun.

Dr. Halena Gazelka 10:01

Our thanks to Dr. Ben Brinkmann, an epilepsy scientist at Mayo Clinic for being here today to talk about preliminary research in wrist devices to forecast seizures. I hope that you learned something. I know that I did. We wish each of you a wonderful day.

Narrator 10:18

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