

Value of MRIs in Treating Powassan Virus Encephalitis

[Announcer] This program is presented by the Centers for Disease Control and Prevention.

[Sarah Gregory] Hi, I'm Sarah Gregory, and today I'm talking with Dr. Joshua Allgaier, a hospitalist at Baystate Medical Center in Springfield. He's calling in from Massachusetts. We'll be discussing his article about using MRIs in the treatment of people with Powassan virus encephalitis.

Welcome, Dr. Allgaier.

[Joshua Allgaier] Thank you.

[Sarah Gregory] Many of us are familiar with tickborne illnesses like Lyme disease, but not Powassan virus. What is it? How is it different from the others?

[Joshua Allgaier] Well, Powassan virus, compared with Lyme disease, is a virus; so, Lyme disease is not. And it's very similar in that it's carried by the same form of ticks, but it's different in that the clinical manifestations, or how it affects your body, is very different. And the big thing that's a little bit challenging with Powassan virus is there's currently no treatment for it, so when people have it, it's a little bit more challenging to help them, unfortunately.

[Sarah Gregory] What are the symptoms then? I've heard about it causing meat allergy, but not encephalitis, until recently when it's been so much in the news.

[Joshua Allgaier] So, it's interesting you bring up the meat allergy. I was looking into that and that actually turns out it's from the lone star tick, which is not quite the same. So, the difference is it...the lone star tick is a little bit more common in the southern region of the United States, and this particular virus is more prevalent in the *Ixodes scapularis* tick. It has been isolated in other ticks, but that's the primary vector. So, the main symptoms are, unfortunately again, very nonspecific. It's similar to kinda getting a cold. So, you may have fevers; you may have headaches, body aches. Encephalitis can occur. It's less common and those people tend to have higher fevers, they may have disorientation, they may not be able to walk as well. In our particular case, we had some amnesia issues. And in some cases, there have been reported focal deficits, similar to like you would see in a stroke.

[Sarah Gregory] Why would this virus cause brain inflammation?

[Joshua Allgaier] So, it's not entirely clear why it causes brain inflammation, in general. There are other viruses that cause brain inflammation, and so, in this particular case, it's likely that either the infection is causing inflammation around the area where the actual virus is, or the immune response, in and of itself, is causing the inflammation in the brain. And the problem is, when you have an inflammatory process in the brain, it's a small space with what we like to call "high-value real estate." So, any small issue there can cause very significant clinical manifestations.

[Sarah Gregory] Just...the way you just described it is very disturbing. Your study describes a man who became infected with Powassan virus in November of 2017. Would you tell us about that.

[Joshua Allgaier] So, yeah, so, he was a very healthy gentleman, very active, a runner, in fact. And it's likely that he came across a tick, maybe he didn't know it and got bit. And then he developed these very unusual symptoms, which we don't see very commonly. It was mostly amnesia, he had difficulty recognizing family members. And he gradually improved, but it was only after we had worked him up extensively for, effectively, everything else that we could think of, and couldn't come up with an answer.

[Sarah Gregory] Okay, so as you just said, you ran a lot of different tests before figuring out what the man had. Why was it so difficult to diagnose?

[Joshua Allgaier] So, part of it is... in the medical field we have a term that's, you know... "If you hear hoof beats, you look for horses, you don't necessarily look for zebras." So, the most common causes of encephalitis are... in his particular demographic would be potentially herpes, or he could have had... Lyme disease is another thing that we looked at, or other types of diseases that can cause high fevers in his type of neurological ick. So, meningoencephalitis from several different causes could present with these symptoms. We had, unfortunately, negative workups for all of the initial things, including an entire PCR panel for meningoencephalitis. So, ultimately, because of his exposure risk, we did add on the Powassan to his serum and CSF studies, but unfortunately, that particular test takes approximately 40 days to come back, just by the nature of how it's run by the CDC.

[Sarah Gregory] Okay, so there isn't any kind of antibody test for it?

[Joshua Allgaier] So, it *is* an antibody test, in fact. They test for igG and igM at the CDC. And I can't speak to the exact mechanism of the test, in and of itself, but I do know that they test for those particular immunoglobulins. And it takes a very long time for them to isolate it, probably because of the, you know, unusual nature of the assay itself.

[Sarah Gregory] Okay, so when I was reading your article, it... I was getting the feeling that the tests weren't done at CDC for a month after his discharge, but you're saying it takes that long to do the test?

[Joshua Allgaier] So... that's a good question. To be perfectly honest, I'm not really sure. It's... it was more of... so, when we order the test at Bay State, it's a send-out test. And so, we order it, they take the samples, they send it to the CDC, and I know that it takes approximately 40 days for it to get back.

[Sarah Gregory] Okay.

[Joshua Allgaier] You know, that's... I'm guessing that it takes probably a month for them to run.

[Sarah Gregory] Is there a treatment for Powassan virus?

[Joshua Allgaier] There have been treatments tried in the past, with... with unclear success. So, antibiotics won't affect it, as it's a virus. And there is no known antiviral that exists currently. So, the tri... the trials in the past have attempted steroids and IVIG, which are basically to treat an immune response, in general practice. And they've had mixed results. Some people tend to get better and some people don't. But it's unclear if either one of those treatments has had a specific effect on these patients.

[Sarah Gregory] Um. Okay, so this particular study is about a technique called “serial brain magnetic resonance imaging” or “MRIs.” Would you describe this?

[Joshua Allgaier] MRI’s findings is more for, in our case, prognostication and for evaluating for the disease. So, the “serial” part is taking more than one image to monitor how the disease has progressed. In our case, we took an MRI initially and it had some...some changes that were fairly nonspecific and showed inflammatory changes in the center part of the brain. And then as we had continued throughout his course, and he was clinically improving, although his improvements were very hard to quantify, because he would remember people a little bit better, but it was not as though he remembered more things, so to speak. And so, to kind of follow up on that, since it had been so long that he was in the hospital, we repeated the MRIs and found that the findings were improved as compared to the original.

Now, obviously, this is one case and I can’t say for sure that they...that the MRI...serial MRIs definitely prognosticated his improvement in this case, but it’s definitely interesting. And if I were to talk about using it in the future, if we found in larger studies that MRIs did in fact show clear differences in the way people are improving or not, it could be useful in studying experimental treatments. So, if you had a treatment that you were testing and you could monitor the MRI, and it would give you a very definitive answer on whether it was working or not—that’s obviously way far down the line and we’re not even close to that—but that would be a potentially use for this technique.

[Sarah Gregory] You might have already sort of answered this, but could you just clarify maybe a little bit more—why is it important to estimate a patient’s prognosis?

[Joshua Allgaier] So, that’s a good question. I think, in our case, the main reason for the prognostication is it’s simply helpful for the patient and the family to know: Is this something that’s going to affect my life forever or is this something I may recover from? You know, am I going to be able to go back to work? I am I not going to be able to go back to work? Am I going to need help at home? Am I going to be able to live at home? You know, in someone who has neurologic deficits, it can be extremely important to know how...what the long-term outcomes may be. More useful, potentially, is if someone were in a case where they were much sicker, and you didn’t know, are this...is this patient going to get better or not, it may help you have more of a conversation with the family to, you know, say: “Hey, we think they’re going to get better, we just think it’s lagging, you know, we should...we still think we should continue” or conversely, you know, “There’s not a whole lot of change, we not sure how they’re going to do, but it’s not looking great.” You know, both of those situations can be helpful and really, you know, having a decision made by both the patient and their family and the doctors, with a shared decision making about how one might want to progress with the disease. And that’s more of a general “Why is prognosis helpful?”

[Sarah Gregory] Okay. Sort of touching on the same thing, how do you think MRIs could be used in the future to help treat this type of disease or any other similar disease, for that matter?

[Joshua Allgaier] So, I think the value in the MRI, as we were talking about a little bit before, is having a more concrete or an objective sign of disease change, whether it be worse or better. If I could tell you the MRI findings correlate exactly or at least correlate well with how the disease is going to progress and whether or not a patient is going to recover or not, it’s much easier to use an MRI finding as opposed to saying, you know, “Maybe they’re stronger on that side that they

were weak,” or “Maybe their memory is a little bit better.” It’s just that there are...while we have certain measurements of clinical neurologic disease, such as the mini-mental status exam, which isn’t built for this, and we have, you know, clinical neurologic exams, I think that in someone with such subtle neurologic findings, as in our case, it’s very difficult to monitor progression of disease without some form of objective finding, like a lab test or, in this case, an MRI, and....

[Sarah Gregory] Why an MRI versus a CAT scan?

[Joshua Allgaier] So, a CAT scan simply doesn’t show the changes that we had discussed. So, the CAT scan is not sensitive enough to find the inflammatory changes that we saw on the MRI. I can’t say for sure what the specific differences are, but that was the case. So, his CAT scan was totally normal, for example.

[Sarah Gregory] Ahh. And reports of Powassan virus have increased in recent years, especially, of course, in New England and the northern Midwest. Do you know why it’s increasing?

[Joshua Allgaier] I don’t know exactly why it’s increasing. It’s, you know, this is one of those questions that exist with many other diseases. It’s...is it really increasing or are we just finding it more? It’s possible that the disease has always been, you know, more prevalent than we thought it was, but we’re more likely to diagnose it because we’re more aware of it and doctors are sending off the tests more frequently. That could lead to what looks like an increasing rate of cases when, in fact, it could just be an increased rate in diagnosis. You know, many of the patients that have Powassan, don’t necessarily have such drastic changes. Now, why someone would test somebody with Powassan...for Powassan, without the drastic changes, I can’t say for sure, although it is possible with changes in, you know, the tick populations. Maybe they’re moving to different areas for...due to climate changes or due to they’re getting pushed out by, you know, different ecologic systems. It’s hard to say for sure, but it’s not entirely clear right now whether or not it’s simply the higher level of...or the more common diagnosis or if the disease is actually more common than it was previously.

[Sarah Gregory] And personally, I find it odd that in a relatively cold climate—I mean it gets really cold in New England and the Midwest in the winter—has most of the bad tick diseases. Why don’t they die out in the winter?

[Joshua Allgaier] I’m not terribly familiar with tick life cycles, however, I think that, similar to Lyme disease, we see it specifically with the ticks that just happen to live in this region. It could be ‘cause of the animals that they’re associated with, you know, they’re more familiar with deer and small game. And it could also be that they simply are built for that climate. I can’t say for sure why they don’t die out in the winter, or if they do die out in the winter, but maybe they lay all their eggs by that time. And so, they pass it on somehow. But I think that what we do know is that the ticks in that particular region have Powassan and are clear vectors of the disease.

[Sarah Gregory] Well, knowing that then, how can people protect themselves from this disease or all the other tick diseases?

[Joshua Allgaier] So, avoiding tick bites is really the best way to prevent the disease, you know, so things like using bug spray on your ankles if you go hiking or you’re outside, making sure that all your pets are treated with tick repellants, and making sure that you’re checking for ticks regularly. Now, Lyme disease, for example, has very specific and a fairly well-documented rate of transmission, so the tick has to be on you for a certain period of time. I don’t know and I don’t

think that anybody knows if that is true for Powassan. Now there are other tick diseases that can be transmitted in a much shorter period of time and I think the safest thing is to check yourself for ticks as soon as possible and make sure that none of them have attached and getting them off of you as soon as possible is the best prevention that you can have.

[Sarah Gregory] This may seem like a silly question, but I've wondered it for years: Dogs get medicine to prevent ticks, why can't people?

[Joshua Allgaier] People can have a type of "treatment" for prevention of ticks similar to what pets may get. Many outlets will sell clothing that's impregnated with an insect repellent called "permethrin" and that can be very effective in keeping ticks off your person to begin with.

[Sarah Gregory] Tell us about your job. What is a hospitalist and what do you do and what do you enjoy most about it?

[Joshua Allgaier] As a hospitalist, I generally see people in the hospital. I don't run an office-based practice. I really like the variety in cases that I get to see. You know, I may see someone for a straightforward cellulitis or an infect...a skin infection, and then, in the next room, I'll see my patient here, with a very unusual encephalitis that I have to figure out. And it's really rewarding, especially when you can have these kind of diagnostic cases where you find an answer, and in other cases, if you can find an appropriate treatment, it's really rewarding to see people get better from these kind of diseases.

[Sarah Gregory] So, you came to write up this study because you had been personally involved in it, is that what happened?

[Joshua Allgaier] Yes. So, I took care of this gentleman throughout the beginning of his course. He was at the hospital for approximately a month; I took care of him for the first two weeks. And I was the one who sent off all of the testing that we did. And then I had...honestly, I'd gone off service, I was, you know, on a different service a couple weeks later, and I got a call from our lab that had gotten the results for the Powassan test and they basically said, "We're not really sure what this is, but we thought we would tell you 'cause you were the one who ordered it. That's kind of how all of this came to be. So, I got to follow him up in the computer to see how he was doing, because he was continuing to see the neurologists for the question of seizures that he had while he was in the hospital.

[Sarah Gregory] You live in Massachusetts, so you're in the hot zone. Do you worry about these diseases for yourself?

[Joshua Allgaier] I do. I think it's tough because you can't...you can't necessarily let them rule your life, obviously. And I know that the cases of this particular disease are few and far between. So, the risk is not necessarily high even though it is there. So, while I do worry about it, I try not to let it affect me in the way of preventing me from doing the things that I like to do, like being outside, and going hiking, and going camping, these kind of things.

[Sarah Gregory] And that would be the same thing for Lyme disease, too, right?

[Joshua Allgaier] Yes, although fortunately, with Lyme disease there's much better treatment. So, you know, you can just take a dose of doxycycline if you're unclear and if you have...meet clinical criteria for, you know, a prophylactic dose, for example.

[Sarah Gregory] And in your opinion—off the topic of ticks, maybe—what is the most important issue in public health right now?

[Joshua Allgaier] Well, that's...it's a tough question. I think...When I think about public health, I think the biggest issue I see with the patients that I take care of is either misinformation or misinterpretation of information. I think a lot of people have specific preconceived notions about health, in general, and in a lot of what they read or hear in the news shapes that. And not all of it is accurate or even true. And so that makes it really challenging to take care of people who, you know, for example, take a pill, and then they see an ad on the television that says that pill is going to have some drastic side effects. And then it's challenging to try to tell them that may not be very common and that particular medicine is really important. Or, you know, people may think that "I can't have any of this particular food" or "I have to eat a lot of whatever." And it's just really challenging to try to reorient people to appropriate medical knowledge and avoiding this kind of misinterpretation or misinformation that gets blasted across media.

[Sarah Gregory] I would think that, particularly right now, social media, so much...just had a conversation with somebody the other day that...I couldn't convince her. She kept saying "social media says that vaccines are bad."

[Joshua Allgaier] Right. Great example! It's really tough to say "You know, we have all this evidence and, you know, I know you don't understand what the evidence specifically says, but trust me when I tell you that it says this..." And, you know, it's tough because they may not trust you and they may trust what they read on social media more, and there's not a whole lot you can do about that, unfortunately.

[Sarah Gregory] Sadly true. Well, thank you so much for taking the time to talk to me today.

[Joshua Allgaier] Thank *you*.

[Sarah Gregory] And thanks for joining me out there. You can read the October 2019 article, Possible Prognostic Value of Serial Brain MRIs in Powassan Virus Encephalitis, online at cdc.gov/eid.

I'm Sarah Gregory for *Emerging Infectious Diseases*.

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