

The ECG in Lyme Carditis

Announcer: Welcome to Mayo Clinic's ECG Segment: Making Waves, Continuing Medical Education podcast. Join us every other week for a lively discussion on the latest and greatest in the field of electrocardiography. We'll discuss some of the exciting and innovative work happening at Mayo Clinic and beyond with the most brilliant minds in the space and provide valuable insights that can be directly applied to your practice.

Dr. Kashou: Welcome to Mayo Clinic's ECG Segment: Making Waves, continuing medical education podcast. Join us every other week for a lively discussion on the latest and greatest in the field of electrocardiography. We'll discuss some of the exciting and innovative work happening at Mayo Clinic and beyond with the most brilliant minds in the space and provide valuable insights that can be directly applied to your practice. Welcome to Mayo Clinic's ECG Segment: Making Waves. We're so glad you could join us today. Today, we have a great episode plan for you as we discuss Lyme carditis in the role of the ECG. We have an expert discussing joining us who will help us better understand this topic so let's get started. Lyme disease is a common tickborne bacterial infection. In the United States, most cases of Lyme disease occur in the Northeast, Mid-Atlantic, and Upper Midwest regions. In Canada, the prevalence continues to rise. If this bacterium infiltrates the myocardium, it is referred to Lyme carditis and can result in impaired electrical conduction in the heart. In this episode, we will discuss Lyme carditis, including the role of ECG, management, and potential cardiac complications if left untreated. We are fortunate to have a world expert on this topic, Dr. Adrian Baranchuk to discuss this further. Dr. Baranchuk is a professor of medicine at Queen's University in Kingston, Ontario, Canada. He serves as the editor in chief of the Journal of Electrocardiology and JACC in Spanish. He is the past president of the International Society of Electrocardiology, the current vice president of the internal, International Society of Holter and Noninvasive Electrocardiology and he's the president-elect of the Interamerican Society of Cardiology. His contribution to the medical field is undeniable with more than 600 authored medical articles, 57 book chapters and 10 books, and that continues to rise. Dr. Baranchuk, what a true honor to have you back with us. Thank you for joining us today.

Dr. Baranchuk: Thank you very much, Anthony, for having me here. It's a true honor to participate in these radio podcasts.

Dr. Kashou: You know, we had such a good time with you last time. I figured we'd now touch on another area that you've been leading the way in and that's in Lyme carditis. And so maybe we could start and you could share what is the role of the ECG in the diagnosis of Lyme carditis.

Dr. Baranchuk: As you very nicely point out, Lyme disease continues to be a considerable problem both in the US and in Canada. And now there are more and more reports of a Lyme disease in Europe. And the problem with this condition is that when it does affect the heart, and we call it Lyme carditis, it can be rapidly progressive to stages where life could be compromised. In simple terms, an inadvertent compromise of the heart can lead to the patient dying. The way that the heart is affected has two major clinical presentations. One of them is quite dramatic, and we call it fulminant myocarditis. For some reason, that happens in a small proportion of the patients. The vast majority of the patients that have Lyme carditis, which is around 10% of the

total population with Lyme disease, it may present with different degrees of shutdown of the electrical system. That means, remember, the heart is contracting on its own because it has automaticity to make the electrical system to work without dependent in us giving any directions to it. You can put your hand up but you cannot make your heart to go faster or slower. It depends on automatic system that regulates our heart rate. Well, it happens that this bacteria has a predominantly attraction for the conduction system and that can produce different degrees of malfunction from something that may not even produce symptoms to a complete shutdown of the electrical system that is, if it is not properly detected, untreated, the patient could die.

Dr. Kashou: That's interesting to think that it has this predilection for the conduction system once it infiltrates it and I guess once you suspect it, how do you monitor the heart rate?

Dr. Baranchuk: That's a great question and it help me answering the final part of your first question, which is what is the role of the ECG. The ECG, as most of you guys know, is a system to record the electricity of the heart but using electrodes on the chest and on the arms. It's very easy to do. It's highly reproducible. So the ECG that you do in the Mayo Clinic is the same ECG that we do here at Queen's University or in Japan or in France. It's easy to be transmitted. We can use a digital platforms to send that ECG from a remote area to a center where there's somebody that can interpret that ECG. What is the role in Lyme carditis? Usually, Lyme disease affects mostly young individuals that in the vast majority do have normal hearts. So if you suspect Lyme disease or you confirm Lyme disease, the ECG quickly can tell you if the heart is being involved in the process or not. Remember, when the patient presents with symptoms and the symptoms can be fainting or extreme dizziness, it may happen that already the electrical system is completely taken. However, if we promote doing ECGs to all patients presented with a high degree suspicion of Lyme disease, we may find that some of them presents with mild alterations that could be aborted or delay in the progress with the proper use of antibiotics. And this is why the ECG now has a relevant feature not only Lyme carditis helping us suspecting this, but also in Lyme disease to determine is it true that it's only 10% or 10% of patients presented with Lyme disease that we know that they have Lyme carditis are those that we detect because they became symptomatic, and then we did an ECG. So this is a discussion that is currently on the table and we are advocating to try to expand the use of the ECG in every single individual presenting with Lyme disease or high suspicious Lyme disease.

Dr. Kashou: It's really fascinating knowing that, you know, young individuals are the group most commonly affected and, you know, presumably, you know, they'd have a normally ECG. So if you can capture even a slight, you know, conduction defect, it may help before, you know, they end up to the emergency room fainting. That's really fascinating. And how about the role of heart rate? Is there anything we have to do there or with subsequent ECGs?

Dr. Baranchuk: In terms of heart rate, when you are having slight defects of the conduction system, you could still suspect Lyme carditis with the heart rate being normal. Now, when you know your heart rate and you know that you operate in the rate of 60 to 70 and now you have dizziness with a pulse rate of 20 bits per minute, that becomes an emergency because that can be an indicator that the system is failing. And we do not know when that failure will take you to have no cardiac beats. Those are the most traumatic cases. We call that complete heart block. When there is a complete shutdown of the electrical system, those patients need admission, need

to be under monitoring care and some of them, if this low heart rate is too profound may have require temporary pacing. That means squeezing a line directly to the heart to secure a minimum of 60 bits per minute.

Dr. Kashou: Hmm, that's really fascinating. And then how about the group that say has underlying maybe first degree AV block, right? And I guess there's no prior ECG, how do we suspect Lyme carditis in a patient like that?

Dr. Baranchuk: All right. So I'm going to take your question into two different stages. One is how do we suspect Lyme carditis in any patient presenting with any degree of AV block. When you say first-degree AV block, that is a minor delay in the conduction. When I say complete heart block, that is a total interruption of the conduction. So to answer this first part is that about five years ago, we developed an score to be applied to patients presented with different degrees of conduction disease. Why different degrees? Because we do know that you can go from your first degree that you were mentioned, Anthony, to a complete shutdown of the electrical system in a matter of hours. So this is why the score that I'm going to describe with you applies to any person presenting with symptomatic conduction disease. And this is the so-called SILC score, the Suspicious Index in Lyme Carditis. And we have created and an acronym that helps healthcare providers to think about Lyme carditis when they are seeing a patient that came symptomatic with a pre-fainting or a fainting episode, and they see different degrees of electrical shutdown. And that acronym reads COSTAR like the costar in a movie. So the C is for constitutional symptoms. So if you have malaise, fever, lack of energy, you get a point. The O stands for outdoor activities/endemic regions. So if you are a person working in the office from office to home, and you never are outdoors, you get a zero, but if you are walking your dog or you will go to work or exercise in the outdoors, then you get a point. The S is for sex. Male sex has a predominance of nine to one versus women. So why is that? We don't know exactly. It could be simply that in our societies, men are more oftenly, more frequently working in the outdoors than women. It could have to do with that or with something that we still don't understand. The T of COSTAR is the tick bite. So if you come to see me with a shutdown of any degree, any degree, and you tell me that four to six weeks ago, you have removed a tick from your armpit, from your groin, from your legs, that gives you three points. It's a very solid indicator that Lyme carditis could be the reason of your electrical shutdown. The A is for age less than 50. You get one point. Why? Because these shutdowns of the electrical system are not common in young individuals. Usually, this is presented by people much older than 50 years old. So if I have a 14-year-old kid presenting with some of the things that I mentioned to you and he recollects having removed a tick, this is Lyme carditis until you prove otherwise. And finally, pay attention to this one is the R of the COSTAR acronym, and R stands for the rash. And I know that some people knows how the Lyme disease rash looks like. It's like a target, a bullet eye, a bullseye target that is quite characteristic. But the point here is that that science that gives you four points, it's only present in less than half percent of the people presented with Lyme carditis. And we have published a case in a woman, rare, 56 years of age, rare, more than 50, that was treated during two weeks because of a triangular rash on her shoulder. It end up being Lyme carditis. So the SILC score still gives you directions but there are a lot of outliers. And this is why we're so pleased to be in your program talking about this because still, healthcare providers need to remember that Lyme disease is out there, and that at least 10% of them will present with a serious heart condition.

Dr. Kashou: Hmm. It's really fascinating in that SILC score is tremendously helpful. You know, I thought of it during, not the score, but Lyme disease, we think of it more when we're doing, you know, internal medicine, but you're right. Even as a cardiologist, we have to think about it because if gone untreated, you know, we can end up with things. And that gets me to the next question. You mentioned some of these patients may need temporary pacing, right? If their rate gets too low. You know, which patients need pacing or do some of them wind up needing permanent pacing?

Dr. Baranchuk: This is the \$1 million question and what took me through the world to deliver conferences specifically in the diagnosis and management of this condition. So the algorithm that we presented in 2019 in JACC is now the algorithm that the CDC is using to determine the flow of action once you have diagnosed this condition. So if the patient presents with evidence of Lyme carditis, it should be admitted to a unit with a monitor. Why? Because even if the electrical shutdown is partial, we know that a proportion of patients will continue to evolve to a more dramatic condition. If at the presentation, the slow cardiac rhythm that we call bradycardia, it's quite pronounced and producing symptoms on the patient, in the past, before all those studies that I'm mentioning now, the patient could get a pacemaker for the rest of his life. And now we're talking, I don't know, a 22-year-old kid that will have to replace the battery every 10 years so six times during his life with a risk of a serious infection of 2 to 3% every time that we change the battery.

Dr. Kashou: Hmm.

Dr. Baranchuk: Not to talk about the mental health issues associated living as a young individual with a device that supports your heart. But the point here is that if you get proper treatment with antibiotics, this shutdown is transient and now we have proved that there's no long-term effects. We published last year the long term follow up of these patients that were treated with antibiotics did not receive a pacemaker. And with an average of 24 months later, they are doing their normal lives. So we have exchanged 7 to 10 days of antibiotics in a hospital by a life living with a device. However, Anthony, few of them, the bradycardia is so pronounced, the slow cardiac rhythm is so intolerable that we do put something called a temp-perm pacemaker. What is that? That is a real pacemaker wire that goes into the heart. It gets externalized below the clavicle. We hook it up to a battery outside the body and we paste the battery on the chest. And with that, we can ambulate the patient from day one because, think about it, 22-year-old guy working as a roof fixer doing full activities presents a fainting, comes to hospital and he said, "Now you're going to be admitted with a wire in your neck for the next 7 to 10 days but please do not move for seven days." What? That is the so-called temporary wire. So we adopted a technique called temp-perm where the patient gets this device and to prove my team on the difference between the classic temporary wire versus the temp-perm, I asked the patient to walk with me from the table where we put the wire to his bed in the unit, meaning you don't stop ambulating. Next day, this guy was in the solar room watching TV and chatting with a friend while waiting for the antibiotics to make its work. By day five, we've been able to take the wire out completely and now we're doing something in a systematic manner, Anthony. We are putting these people on a treadmill before sending them home. Why? Because we want to see how much that conduction system can tolerate.

Dr. Kashou: Hmm.

Dr. Baranchuk: And if in the treadmill, your heart rate goes above 120 beats per minute, the only thing we do is we see you in four to six weeks with an ECG, all right? And then we see you at one year with an ECG. If in the treadmill, you didn't do that well, well, we see you at four to six weeks with an ECG and another treadmill to see if you kept improving. So the beauty of this is that this approach allow us to determine that this is a transient condition. That if properly treated, it results in a matter of 5 to 10 days, that three weeks of antibiotics in total is the perfect dose. So when you go home, you don't continue with IV antibiotic. We switch to antibiotics PO. And that at four to six weeks, you need a control to be sure that everything is in place. And then when we see you at one year, everything is perfect. So far, no patient relapsed, no patient got reinfected because they learn all the process and measurements that they can do to avoid further infection and to continue doing activities in the outdoors, right? So the system works, and we are extremely happy with the value that the simple ECG give us to make the diagnosis and then to do the follow-up.

Dr. Kashou: It is really tremendous to see the importance like you mentioned from the initial presentation through monitoring of what the disease course might look like, what to look out for, the need for even pacing. And you've already got to my next question which was how do you follow these patients in a role and you've already answered that. It's really amazing to see the work you've done, and I will have to check out that JACC article in 2019 and which is now used by everyone across the world. So thank you so much.

Dr. Baranchuk: So thank you, Anthony, and thank you, I thank the Mayo Clinic to help us spreading the voice about that. We're very happy. Now, every two to three months, different groups across the world are validating the SILC score so using it in their populations, right? Lyme is not the only transient cost that can produce electrical shutdown but maybe it is the cost in North America for a transient condition that can be recovered without having to pay, and I'm not talking about money. I'm talking biological cost of implanting a device in a young individual for the rest of his or her life.

Dr. Kashou: Hmm.

Dr. Baranchuk: So thank you so much for helping us passing the message.

Dr. Kashou: The prevalence of Lyme disease continues to rise. If left undiagnosed or untreated, it can infect the heart and result in conduction abnormalities, as we saw today. And even if left untreated further, death which is something we had never wanna get to. So prompt diagnosis and antibiotic therapy can be effective and improve the prognosis in these patients. I hope you found today's episode informative and learn something because I sure did. Dr. Baranchuk, thank you for sharing your expertise in helping us better understand this important and seemingly under-discussed topic. On behalf of our team, thank you for taking the time. It's been a true pleasure.

Dr. Baranchuk: Thank you.

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