

Episode 185: The Vagus Nerve and Its Impact on Migraine and Headache

Lindsay Weitzel

Hello everyone, and welcome to Head Wise, the videocast and podcast of the National Headache Foundation. I'm Doctor Lindsay Weitzel. I'm the founder of Migraine Nation, and I have a history of chronic and daily migraine that began at the age of four. I'm excited to tell everyone that I am here today with someone who's sort of famous in our community.

This is Doctor Shin Beh. Hello, Doctor Beh, how are you?

Shin Beh

How about you?

Lindsay Weitzel

I am doing well. Doctor Beh is the founding director of the Beh center for Vestibular and Migraine Disorders. Some people in our community know him as the dizzy doc, because he's so well known for working with people with vestibular disorders. So, I have him here today because I want to talk about something that I know he is really well versed in.

It is the vagus nerve, and as nerdy as it may sound, I'm really excited to talk about the vagus nerve because, it just it's really confusing. Everyone is talking about it right now. but I, I, I think that we don't really understand it because we're told that migraine sort of starts in our brain and then involves the trigeminal nerve, but then we're told that it involves, the vagus nerve that's somewhere in our neck, and then it's really long.

And believe it or not, it wanders down to your GI system somewhere. And then I think the coolest thing I learned while I was, sort of looking at background for this podcast is that vagus actually is Latin for the word wander, because this nerve wanders so much. So just a tidbit of background on that one. So, why don't you tell us a little bit of background about yourself for people who don't know who you are, why do you love working in this field so much?

Doctor Beh?

Shin Beh

So, I'm a neurologist who specializes in vestibular disorders. I see people with neurological conditions that called vertigo and dizziness. I like it because, you know, not a lot of physicians who specialize in this area. And so, you know, there's a huge need a lot of patients suffer with, dizziness and vertigo. It's the second most common, you know, symptom people go to see a doctor for after headache.

And so, by the number of people who specialize in dizziness and vertigo is much fewer than people who, you know, specialize in headache at this point in time. Now, of course, that will change over time. And, you know, things will catch up. But, you know, it's a very rewarding field. You know, it's, you know, we find that there's a lot of things that, you know, we can do for people with dizziness and vertigo, just like how, you know, headache.

You know, we're seeing so much progress at headache, mouth, dizziness and vertigo. I think that will soon catch up.

Lindsay Weitzel

so, let's start just with, where is the vagus nerve located? is there more than one and what does it do.

Shin Beh

So, the vagus nerve is one of the cranial nerves. The cranial nerves that name because they start the brain and they come out of the brain. Right. So, they were named because, you know, they exit certain parts of the skull. And so hence the name cranial nerve. The vagus nerve starts in the brain stem, the lower portion of the brainstem called the medulla that exits the nuclei, the central parts of the vagus nerve, if you think about it like a computer.

Right. The easiest analogy would be the CPU itself is contained within the brainstem, and the cables exit the body. Extend these cables with what we call the vagus nerve. It is the biggest of the cranial nerves. So it comes out of the brainstem, exits the skull, travels down the neck, and as it travels down the neck, you know, and goes to the rest of the body, it supplies many different organs, supplies the heart, your lungs, the blood vessels it supplies the gut, the bladder, bowels.

All of these things, you know, are supplied by the vagus nerve.

Lindsay Weitzel

what is it? What is its role? as far as when you say supplies.

Shin Beh

So, the vagus nerve plays a very, very important role. So, it connects the different organs of the body to the brain. Right. And so, it conveys information and in both directions it takes information from your lungs, your heart, your gut, your blood vessels, takes it back to the brain. And, you know, the brain processes that information and decides what you need to do or what the body needs to do to maintain your health and physiology.

And it sends information back to the gut. The lungs, your heart or bladder and tells that those organs what they should be doing. So, the vagus nerve is part of what we call the autonomic nervous system. So, it's the involuntary or unconscious part of your nervous system, the functions that tend to run in the background. So, if you think about it like your breathing, digestion, heart, heartbreak, you don't have to consciously think about these things, right?

Which thankfully is can you imagine how much, you know, bandwidth that will take up. Right. So, it runs in the background. It helps us maintain these very vital functions for survival. Your autonomic nervous system can be divided into two. You know, it's like a yin and yang, right? You have the sympathetic system, and you have the parasympathetic system the most, you know, the simplest way of dividing that nocturnal up would be, you know, your sympathetic system is your fight or flight system.

And the parasympathetic system is the rest and digest functions. So you have one system that is tasked with, you know, raising, you know, the heart rate, raising the blood pressure, preparing you for, you know, any situation that's stressful to your or to the body in order to guarantee your survival in certain situations. And you have a system that calms things down, keeps things quiet, and works.

You know, when the organism is not under any form of threat.

Lindsay Weitzel

Okay. so, it's not in other words, it's not one of the nerves that helps us feel pain or move. It's one of the autonomic system nerves. And its sort of if we're in pain all the time, we're sort of pushed into our sympathetic nervous system, and it's the opposite of that. It's one of the nerves on the more calming side of our nervous system.

Is that a good way to put it, though?

Shin Beh

It's you bring up a very interesting point. So, it's not that it doesn't convey conscious sensation that sense. Right. So, like say, you know, if I pinch your hand, you know, that feeling doesn't go through the vagus nerve, right? Directly, but it actually can convey pain signals from your organs, right? So, if you, you know, you have like a, you know, a lot and you're very bloated, the pain signals from there can, you know, influence that vagus nerve and be conveyed to the brain.

or if it's like, you know, pain around heart, for example, like having a heart attack, you know, those types of pain signals can be conveyed through the vagus nerve, but not conscious sensation. So, one called somatic sensation.

Lindsay Weitzel

Okay. So, it seems like everyone is talking about heart rate variability. Excuse me. These days and its relationship to the vagus system, why is this important, especially to our audience who is a headache migraine cluster, chronic pain type audience.

Shin Beh

so, heart rate variability, you know, refers to the changes and the time intervals between consecutive heartbeats. Right. The heart is really not a metronome. It does. And beat at a separate all the time. It changes. It varies in accordance with, you know, changing physiological conditions in your body. the heart rate variability is generated by connections between the brain and the heart.

Right. And it's the main thing that controls it is the autonomic nervous system. I think one thing I didn't mention earlier is that the vagus nerve is part of the parasympathetic nervous system. It is a very important part of the parasympathetic nervous system. It's basically the main highway where you know, your brain, you know, controls your body through the parasympathetic nervous system.

So, heart rate variability, you know, in a way reflects a dynamic relationship between the sympathetic nervous system, the parasympathetic nervous system. Right. So going back to the whole fight or flight, resting, digesting, you know, your parasympathetic system will bring the heart rate down, slow things down, calm things down, whereas the sympathetic nervous system will ramp it up. Now a healthy system has, you know, good amount of variability in it, right?

So, you know, all stress is not that stress. Right. So, a small amount of stress is good for the body. Short term stress is good for the body. You know that's why we exercise you know do simple things like that where you know exercise exertion actually puts the body under a little bit of stress. So, for short term it is good now.

And but you know in the long-term stress chronic stress when the sympathetic nervous system is overly stimulated then and the parasympathetic activity goes down then that's a bad situation. That is one of the situations that leads to whole heart rate variability, where, you know, things are ramped up so much that, you know, the heart rate really doesn't vary too much.

Now, other things, of course, that cause that would be, you know, stress, depression, anxiety, and of course the headache and the migraine will my pain. But many things can also do it, you know, concussions can do it. You know, asthma, inflammatory conditions, fatigue, lack of sleep, even diabetes can cause heart rate variability. Now, it's not to say that you can have too much of a good thing, right?

So too much variability also is bad. And you see that in you know, typically conditions like cardiac arrhythmia where the heart rhythm just is a bit haywire. There's some interesting, you know, research into heart rate variability and you know how the brain functions. And so, one of the very interesting thing is, is that it may reflect, a person's emotional regulation.

Right. If you think about it, you know, your emotions influence your autonomic nervous system when you're angry. You know, when you get upset, when sad, you know, your heart rate calls. So, blood pressure goes up. You know, that's all activated. And then when you're relaxed, everything tends to calm down. And so, it is belief that, you know, heartbeat variability may reflect how well a person is able to control their emotions and whether their emotional responses are, you know, appropriate or not.

Right. In the same way, we think that perhaps because, you know, people who have better decision-making skills, executive function and attention may have better emotional regulation. And so, heart rate variability may also be an indicator of how good your attention, like your decision making skills, are.

Lindsay Weitzel

Okay, so this is also interesting. we have done an episode before on monitoring like using I showed I point my rig various gizmos, for lack of a better word, to monitor your heart rate variability or other things in the setting of someone that has chronic head pain or migraine. so, in the setting of someone that has a lot of pain or migraine, is our heart rate variability usually lower or higher than someone that's not in chronic pain?

Shin Beh

Not enough research into it so far, but it seems to be pointing in that direction. And you know, you have a lot of pain issues, chronic pain that may be, you know, poor a heart rate variability.

Lindsay Weitzel

Okay, okay. So how is the vagus nerve related to migraine or cluster headache. Because we do know there are a lot of people out there that will stimulate the vagus nerve with stimulators, to prevent or abort a migraine attack or a cluster attack.

Shin Beh

I think important point in neurosciences, we have to think of the brain as next, right? We should not think about it. I think in the past we used to think of it as, you know, just discrete areas of the brain or this area does this, that area does that and that, that. Right. I think a better way of understanding the brain is networks and how different parts interact with each other.

And that can help us understand more about how, you know, vagus nerve stimulation may help with cluster headaches or with migraines. in cluster there is a very strong autonomic component, right. And there is belief that, you know, cluster headache, you know, comes from abnormal activation of the trigger, the neural autonomic system, which is why, you know, in the cluster you have the bad headache, and it comes with all the autonomic signs that you can think of the true pilot, the sweating, you know, the runny nose, you know, once out of patient turn, many different things like that.

Right. So, we believe that it is possible that, you know, vagus nerve stimulation may inhibit the trigeminal nucleus and thereby, you know, control this trigeminal autonomic reflex, from activating a cluster headache. So that is the hypothesis that for cluster migraine is a little bit more interesting. So autonomic symptoms can happen in migraine. you not one of the cores or diagnostic signs in migraine except for nausea and vomiting.

Of course.

Lindsay Weitzel

Many subtypes. So, when you get a migraine you get the teary eye or the runny nose.

Shin Beh

Correct. Exactly. All the droopy eyelid pupil changes in pupil size in the cluster. It's very one sided. Right. And you know whereas in migraine it happens. It's usually on both sides. Right. And so, if you train terminal autonomic system can be involved as well. But I think the more important role is that again going back to the whole network thing is that there is, part of the brainstem, the nucleus tract, the solid areas where the trigeminal system and the vagus system, you know, meet.

And so, the possibility to have a hypothesis rather of how, you know, vagus nerve stimulation may help with migraine is that, you know, by stimulating the vagus nerve, right. It influences activity within the trigeminal system, in the brainstem and in a way indirectly alters the trigeminal activity.

Lindsay Weitzel

Oh, well, okay. So, when I didn't when I did the intro and I said, you know, we don't really understand, it can be complicated. Why are we talking about the vagus nerve related to migraine when most people tell us, you know, migraine starts in our brain and then involves our trigeminal nerve, it might be because there's a connection in our brainstem between the vagus nerve and the and the trigeminal nerve.

Shin Beh

Right.

Lindsay Weitzel

Okay. All right.

Shin Beh

Hypotheses at this step which right. We like these ideas that you know could be.

Lindsay Weitzel

Possible okay I think a lot of people out there think it's because it the vagus nerve is thought of as, because as you said, it's part of our parasympathetic nervous system. I do believe there is, some thought out there that you're stimulating a nerve that helps calm you, sort of like when you meditate or do breathing exercises. Is that not part of this mechanism?

Shin Beh

But it can be, you know, indirectly, of course. You know, the calming part, you know, is always important if you think about it. You know, migraine is everything is wrapped up right the previous and is hyper excitable state. And so, you know, by arming the system down, you know, taming the madness a little bit, you know, that could help for sure.

Lindsay Weitzel

Okay. Is the vagus nerve involved when we do, these types of things to help our migraines? like with the relaxation exercises, meditation, etc..

Shin Beh

Absolutely, absolutely. So, you know, meditation, you know, massage, yoga, exercise, even singing, humming, you know, they can activate the vagus nerve. But I'm sure, you know, if you're in the midst of a biking attack, the last thing you want to do is singing, hum or hear somebody sing and hum. Right. But I think an interesting thing that we often hear about in migraine is, of course, you know, using ice, right?

You could ice and hit ice on the face, you know, so cold water to the face. The head also can activate the vagus nerve cause it does numb the pain away. Could it possibly also, you know, stimulates above vagus activity. I think that's quite possible.

Lindsay Weitzel

Interesting. Okay, so, I have another question because so many people in our community have co-morbidities that are other types of chronic pain, like fibromyalgia, etc. so can stimulating the vagus nerve help with those other types of chronic pain to.

Shin Beh

We don't know right? Yet. We don't have the evidence for that yet. But I think it is possible if you look at, say, fibromyalgia and that is some indication that there is, you know, more sympathetic activation, there's more inflammation going on. You know, vagus nerve stimulation is being explored in reducing systemic inflammation. I think there was a study I don't know the results of the study yet, but they looked at, long Covid, for example, right, where inflammation is believed to play a big role in long Covid.

So, you know, looking at that vagus nerve stimulation in patients with long Covid. now, if we bring in, you know, other aspects, of the vagus nerve and more importantly, connections to the gut, right. a lot of patients with migraine have IBS issues. And so, you know, the vagus nerve stimulation could also influence these things.

Right? I believe that some studies looking into gastroparesis, not only people with you know, have been using vagus nerve stimulation to treat that or if you look at the mood side of things. Right. So vagus nerve stimulation can be useful in patients with depression. they've they've not used the, the external stimulator, which became a device that I believe so far.

Right. But I think there have been studies looking at the, the one that they use in patients with epilepsy when they implant the implantable vagus nerve stimulator in the treatment of depression, anxiety. I believe a study in the VA also was looking at that PTSD, vagus nerve stimulation. So many different comorbidities could potentially be helped with vagus nerve stimulation.

Lindsay Weitzel

Okay, okay. So I'm going to, use another word that I just think I'm just trying to ask questions that I think a lot of us in the community are sort of it feels very hand-wavy. We don't really know or understand the connections. you know, many people have decided phobia, and I think we always wonder, you know, what does that have to do with our vagus nerve?

And why do we also have migraine and this and that? So how is the vagus nerve involved in that? Or is it at all.

Shin Beh

So this autonomy is very general term when it comes to it. So basically it means any problem of the autonomic nervous system right. It could refer to problems of the vagus nerve, you know, as because vagus nerve is a huge part of the autonomic nervous system. I think rather than lumping it as one big group, is more important to perhaps divide them up a little bit, because going back to say, you know, gastroparesis, for example, you know, gastroparesis can be a, you know, indication of this often, in fact, just one of the signs of it.

Right. And so, you know, if you use vagus nerve stimulation to treat that, you know, we can see that's an improvement. other manifestations of this autonomic say, you know, blood pressure issues, you know, for example, you know, I'm not aware of, like specific studies looking at, you know, vagus nerve stimulation to treat those things. Yeah. So I think it's, you know, rather than me of lumping them all as a large group, you know, passing each one out and seeing, you know, what the effect of vagus nerve stimulation could be, other benefits could be what each component would be a little bit more helpful.

Lindsay Weitzel

Right? Okay. So I like this topic because it's it's really kind of pushing the limits of what we, we know. But it is all questions that I think people are interested in. so, the other thing I'm curious about is I is kind of a chicken or the egg question. I think, people sometimes wonder if, if, if they are finding that vagus nerve stimulation helps them.

Is, is it like migraine or cluster headache is a sign that something was wrong with their vagus nerve in the first place, or is it vice versa? Or do we not know this? Or or am I completely on the wrong track?

Shin Beh

I think it's so interesting. Very interesting question there. I think in most people with migraine like cluster, it's not something that's not something like wrong per se with the vagus nerve itself. Right. the autonomic system can be affected for sure in these two conditions, especially cluster, you know, in migraine, you know, that's also possible. And especially if, you know, you have a lot of, you know, issues with migraine, you know, a lot of comorbidities are comorbidities.

With that, of course, eventually there can be some autonomic involvement eventually, right, in chronic stress and all of that. So, you know, indirectly there can be some issues with, you know, the vagus system. Right. But not, I would say like a problem with the nerve itself. And again, going back to, you know, why it helps is within the whole crosstalk networking, you know, connections.

Right. And so it's, you know, you can influence the trigeminal system by, you know, influencing the vagus system. Right? You don't necessarily have to have a problem with the vagus system to use it to try to influence the trigeminal system. Another example that we could use is, you know, the device. Right. So they see see patients a few quite a few dizzy patients, you know, find that, you know, trigeminal stimulation helps with vertigo and dizziness even if they don't have a headache.

You know. So you know, it's like how in the will that happens again working. You know, a lot of networks between the traditional system and vestibular system. And so one possible explanation for that is, you know, information or, you know, changes within the trigeminal system alters activity in the vestibular system.

Lindsay Weitzel

I love the way you said that. Thank you so much. I was trying to find a way to word that, that, it just because it really cared kind of not makes sense to people, you know, was there something wrong that, you know, that caused the migraine in the first place? And I'm fixing it by stimulating or am I just.

But yeah, you know, networks and things that work together, in the nervous system are very, very complicated. And so I find the vagus nerve to be fascinating. And, and extremely complicated. And I think, people like to ask a lot of questions about it online. and so I, I think you you're so knowledgeable about this, and I love the way you're answering these questions, even if they are a little bit off base.

So thank you so much. so what else can you add to, the idea of migraine, migraine, symptoms, etc., and cluster headache when it comes to the vagus nerve that we have not really covered.

Shin Beh

I think, you know, from my side because I see it in patients. Right. One of the things is it can help with dizziness and vertical, so, you know, we did a study where we did, we had patients who came in with

other simple migraine attacks, you know, having this bad vertigo, dizziness, and they had the vagus nerve stimulation done, and it found that it did help with their symptoms.

Oh, and there was another one that we did where we looked at, you know, okay, maybe we could argue if you're dizzy and, you know, it could have been a placebo effect. Right. But if we had a smaller group of patients who had nystagmus as well as, you know, vertigo during the migraine, vestibular migraine attacks.

Lindsay Weitzel

Which got better.

Shin Beh

so this diagnosis, an involuntary oscillation of the eyes, right. So, you know, it's not something that's under control. So you see this? I kind of drift and jerk in different directions. Right. So it's not something that somebody can control. So you know, that one you can definitely say is not a placebo effect. Right. There's no way on Earth you can fake nystagmus or stop loss stack on your own.

Okay. And so we could they we found that, you know, the vagus nerve stimulation definitely help with, those festival of migraine attacks now going, you know, I think, before we started recording, we mentioned that the stop. But the stop is, you know, of course, famous for, giving the name triple PDE, right. Persistent postural, perceptual dizziness.

it was this chronic condition where patients that you see all the time, there's an interesting study from several years ago, but it showed that vagus nerve stimulation actually helped people with that triple PD. And these people had no migraine no cluster.

Lindsay Weitzel

Okay. All right. Well that is super interesting. And it just shows that this nerve is just so important in so many areas. And, and that it can control so much. so I hope we answered some people's questions or cleared up some confusion related to the vagus nerve and why on Earth it can help migraine cluster.

vertigo, etc. so many different things. so thank you so much for being here, doctor Beh. And thank you everyone for listening in today. And please join us again on the next episode of Head Wise. Bye bye.