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eAudiology: Migraines in the Audiology Clinic - What You Need to Know

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Thank you all for joining me. I'm very excited to speak with you all about one of my passions, which are vestibular migraines or migraine associated vertigo. I hope today to share information that you not only find interesting, but also clinically useful. I am a practicing audiologist, so I want to really give you info that you can apply directly in your own clinics when you're seeing patients. So I'd like to talk a bit about what, what the term migraine means.

Now, I think there's a misconception that many of us have that migraine specifically means headache. And really it doesn't. The term migraine represents a complex neurobiological disorder. There are a number of things that are happening in the brain and headache may or may not be a side effect of what's happening in the brain. So that's something I'd like to discuss in detail today.

What's happening anatomically, why people have the symptoms they do, what symptoms they may or may not have, including headache. For someone to have a diagnosis of migraine, it's important that they have recurrent episodes. A single, you know, sort of episode or a single issue really would make it hard to to make that diagnosis. So someone has to have recurrent episodes. Now it's also interesting to note that when an individual is not having what may be considered a migraine in and of itself, they may have changes at their baseline neurologically.

So I'll share with you during today's talk some information related to how people with migraine or migraineurs may be different all the time. Even when they're not having a migraine, they're wired a little differently.

Now, there are several subtypes of migraine. The first is what's called migraine without aura. This is what most individuals with migraine have and this accounts for about 80% of migraines. The second category that we might use to classify migraine is migraine with aura. And individuals with aura have other sensory symptoms to go along with their migranous episodes.

Most often these are visual changes, meaning an individual may see something in their visual field that's not there. They may experience temporary blindness. Individuals may also have changes in speech production. They may have numbness, tingling or other sort of physical manifestations of migraine. There are other several rare subtypes of migraine, the first being what's called a hemiplegic migraine, which creates stroke like symptoms during an episode.

So individuals with hemiplegic migraine may have weakness on one side of the body, facial Droop, et cetera. So those symptoms may look a lot like a stroke. A very fairly rare subtype of migraine is what's called a basilar migraine. An individual with basilar migraine have symptoms that seem brain stem in origin, meaning they may experience ataxia. So poor control over their extremities, vertigo or spinning, dizziness, slurred speech or dysarthria or confusion.

Finally, there's a really kind of a. I wouldn't call this a rare subtype. It is definitely seen clinically. But we have migraine without headache. So some individuals may experience a migraine type aura, but no headache at all.

We can also classify migraines as being chronic versus non chronic. To be characterized as chronic, an individual should have 15 headache days per month. Okay, so almost 50% of the time they would have a day with a headache. Eight of those headaches a month should have migraine features. Migraine features mean sensitivity to light or photophobia, sensitivity to sound, or phonophobia or nausea.

To have a diagnosis of chronic migraine, they had to have been there for at least three months. And there may or may not have aura. Oftentimes, migraines are related to estrogen. Okay? So we call these migraines menstrual migraines.

60% of those with migraine seem to have migraine type attacks during their menses cycle. As migraines are estrogen linked, they're typically passed down the female side of the family. So when I

have a patient where I suspect migraine, I do a family tree and ask about their mother, sisters, aunts and daughters to see if they're also experiencing migraine like symptoms.

All right, so let's talk about the epidemiology of migraine. And some of the numbers I'm going to throw out here are they're interesting. Epidemiologists have a different way of looking at data than audiologists typically do. So I'll try my best to explain this in a way that makes sense to everyone. Migraines are extraordinarily common.

One billion people have a diagnosis of migraine on planet Earth. This is considered the third most common disease on the planet. In people under the age of 50, this is the leading cause of disability.

So this is one of those statistics I was warning you about. Epidemiologists like to look at what's called global disease burden. Global disease burden represents all disease states on the planet. So every disease a human being is currently experiencing, every disease added together would equal 100% of the global disease burden. Migraines account for 5.6% of all disease on planet Earth, they're more common than every other neurologic diagnosis combined.

About 11% of the world's population have been diagnosed with migraine, which is similar to what we see in the United States. We see the migraine diagnosis being made more often in Western countries. We don't know if that's because they're more common or there's more sensitivity to it in our healthcare system, but they are more diagnosed in Western countries.

Migraines are also about two and a half times more common in females. Again, that's probably because of that estrogen link that I mentioned a moment ago. We also see migraines more often in Caucasians, in particular Caucasian females. So 1 in 5 Caucasian females carry a diagnosis of migraine, while about 1 in 10 Caucasian males carry this diagnosis. They're slightly less common in African American females, with about 16% carrying a diagnosis of migraine and males about 7%.

And then the least common in Asian Americans, where about 9% of females have a diagnosis of migraine and about 4% of males.

Now, if we look at incidence, okay, peak incidence of migraine with aura, particularly, we see this most often in 5 year old, 5 years, at about the age of 5 years in boys and between the ages of 12 and 13 in females. Migraine without aura. Typically the incidence is the highest at between the ages of 10 and 11 in boys and 14 to 17 in girls.

Okay. If we look at prevalence, so incidence meaning a new diagnosis prevalence, meaning how many people have that diagnosis in a specific population. If we look at prevalence, most common people have. Most commonly people have migraine between the ages of 25 and 55 in both sexes.

Migraines present a huge burden on the American healthcare system. There are 22 million outpatient doctor visits a year related to migraine at a cost of \$3.2 billion. If we look at ER visits, there are just over 900,000 visits a year related to migraine. So these would be migraines that are so intense that a person has to go directly the hospital. That equates to a cost of about \$700 million annually.

There are 51,000 inpatient hospitalizations a year related to migraine. So a huge number. Overall, the cost for healthcare system are as high as \$4.3 billion annually. This is really an issue that's a huge burden on the healthcare system. Something else that's really interesting, we look at doctor's visits, hospitalization incidents, etc.

Is really the ages at which migraine affect individuals so, as I said during my last slide, most often people between 25 and 55 have migraine. Well, the ages of 25 and 55 are most individuals peak economic years. This is where we're earning the most at our jobs. This is when we're raising children and having a family. So migraine is kind of unique in that way.

They impact us during those years that are most critical during our employment and during our family lives.

Here's another one of those epidemiological statistics. It's kind of confusing, so I hope I can make sense of this for you. Another way that scientists like to look at disease burden is how many years on planet Earth are lived across all people with a certain disability. So basically, what they've looked at here is every individual that has a migraine, how much time are they living with disability, or are they being significantly impacted by that migraine? So 45.1 million years are lived with disability from migraine every year.

So again, if you add up every moment a person's affected by migraine to the point of being a disability, you had all that time up across everyone on planet earth. That means 45 million years are lost annually in productivity because of migraine. When I hear that number, it's shocking to me. I think, you know, what would change if migraine wasn't an issue, if this wasn't something that impacted people to such a degree. I mean, we could have a cure for cancer, for goodness sake.

If we also look at the family and social impact in the United States, the numbers are really pretty devastating. We can see by and large that most individuals with migraine have reduced work productivity. They achieve less in their jobs. We see less social engagement in the family. We also see if we look at children of individuals with migraine that academics are usually worse.

49% of those with migraine indicated they would be a better partner if they didn't have migraine. And just over 3% of those with migraines have decided not to have children because they're concerned about passing this on to their kids. So, again, a huge problem. All right, let's talk a little bit about what's happening with migraine. What's happening anatomically?

Okay, so one thing I'm going to talk about is the course of migraine. So how a migraine sort of develops in the brain, what's happening, how they spread, how they move around to different brain structures, and how they finally resolve.

Well, we consider the first phase of migraine is called the prodrome, and about between 40 and 80% of people have symptoms during this prodrome stage. I'd be willing to bet, and we don't know this for sure, But I'd be willing to bet everyone has a prodrome stage. Just not all individuals have prodrome symptoms during this period. So typically this stage starts several days or even hours before an attack. What you start to see here is there start to become some basic changes in the homeostasis of the brain.

So blood flow starts to change. Oftentimes we see less blood flow or more blood flow in some cases, to be frank, we also see a change in neurotransmitters. So how neurotransmitters are being passed around between neurons in the brain, the baseline in the brain changes. So again, more or less blood flow, more or less neurotransmitters, we start to see activity and regions where there was not activity before. During this, this stage, because of that change in blood flow and neurotransmitter activity and neuronal discharge, we see depression.

So individuals may feel depressed, they may have issues with concentration, they may feel irritable. We also see food cravings, which is interesting, or appetite changes. We think this happens because the hypothalamus suddenly becomes activated when normally it wouldn't be. During this stage of migraine, People may have trouble with sleep. Okay.

They may have insomnia or excessive sleep sleepiness. Again, because of areas in the brain being activated. Some people during the prodrome stage have nausea or sensitivity to light. We think that the visual cortex and the rostral dorsal medulla Are activated With that change in blood flow or neuronal discharge. Some people also have neck pain because of the trigeminocervical complex sort of

activation.

There's a reflex pathway with a trigeminal nerve that kind of connects to certain brain structures, which we'll talk about later. And that's also activated during migraine.

Okay? So after that stage, we get into the aura stage. And you'll remember that only about 20% of people actually experience a true aura, which, again, is a sensory hallucination that's related to migraine. Auras typically last anywhere from about 10 minutes up to about 30 minutes. We think at this point that those changes in blood flow and neuronal activity have spread to the cortex.

Because they've spread to the cortex, they may influence the occipital lobe, which is why most people with aura have visual auras. This may occur before the attack of the headache attack or during the headache attack. Or you can have an aura with no Headache at all. I've got a video to show you of what a typical aura looks like in somebody with migraine. So I'd like to thank the Mayo clinic for developing this video.

But as we'll see, in this individual's right visual field, There starts to become a blurry sort of section. We'll start to see some flashing, some colored lights. And over time, as that migraine expands, as more areas of the brain are involved, As a greater degree of the occipital lobe has a change in blood flow, depolarization of neurons, that aura will get bigger and bigger again as more of the brain is involved. So we'll see some very significant changes here towards the end in that right visual field. So, again, this would be considered a fairly typical visual aura related to migraine.

So what we'll see, though, that eventually will kind of fade away over about 10 to 30 minutes. Then the individual may be left with headache.

Okay. Following the aura phase, we have what's called the headache phase. So if we're talking about headache with migraine, that headache should have a few key features. One is that it would be considered moderate to severe. Most migraine headaches occur on one side.

So they're unilateral, they typically throb or pulsate, and they're worse with physical activity. With this headache, it typically comes nausea, Sensitivity to light, and sensitivity to sound. A migraineous headache can last anywhere from four hours up to 72 hours. With that being said, there are some individuals that have migraine headaches that last last much longer, but they're rarely shorter. So there are people who have migraines that have last that last for days and days until they take, you know, rescue medication or they're seen by their physician to give some sort of medical management.

But typically they last anywhere from four to 72 hours. We believe that the headache and migraine is related to activation of that trigeminal vascular pathway that I talked to you about earlier. This pathway connects to the thalamus. The thalamus is one of the areas of the brain that modulates sensory information. So pain reception.

The surface of the brain, or the cortex, doesn't have a lot of pain reception. So activation of this reflex pathway is what causes headache or pain in individuals with migraine. Following the headache phase, we have what's called the postdromal phase. This can last for days. Typically, an individual during this phase would be really characterized as an individual feeling like they have a hangover.

That's a typical sort of report from your Patients. So an individual may feel tired, they may have neck discomfort or pain. They may have trouble concentrating. They may just really feel wiped out, like they really just went through something pretty severe. We don't know exactly what's happening during this phase.

There's not a lot of good clinical research, really bench research, looking at this phase of migraine. The theory is that the brain's now resetting to its homeostatic state. So all the neurotransmitters are going back to kind of the levels they should be at, Blood flows returning to what we would consider normal. You know, the neurons that have depolarized are now kind of going back to where they should be, and things are going back to what we would consider a normal brain.

Now, this phase of migraine is the phase that I consider the most interesting. It's called the inter ictal phase. This phase is really defined as the period between episodes. So during the interictal phase, technically, an individual should be symptom free. However, when people during this stage receive a functional mri, which allows us to see brain activity, we'll see altered brain function.

Meaning individuals with migraine, even during the symptom free stage, may have brains that work differently than people without migraine. So what we'll see is some of those areas are related to sensitivity to sensory information, are lit up. Individuals with migraine during their symptom free stage, or their interictal phase may have cognitive changes. Okay. They may have issues or sensitivity sensory information.

So increased sensitivity to smells, to taste, to sound, to visual input during this stage, again, when a person's quote, unquote symptom free, they may also have increased dizziness or balance problems. So what I find so intriguing is that individuals with migraine, they may have brains that are different all of the time, even when a migraine is not technically being experienced.

All right, so let's talk about some of the conditions that go along with migraine. In those with migraine, we see a higher incidence of stroke. We think this occurs because of some of the vascular changes that are occurring with migraine. So during a migraine, we see vascular inflammation or vasospasm, which can both lead to stroke. We also can see some subclinical microvascular brain lesions, meaning if an individual gets an mri, you'll see spots on the MRI that's occurring because of the inflammation,

this process, we see inflammation that kind of comes and goes and comes and goes.

As an individual experiences migraines over time, which causes wear and tear in the brain, which you can see through Imaging. We also see increased rates of coronary artery disease in those with migraine. We don't know why. We don't know if migraines for some reason are causing heart disease or if heart disease is causing migraine. So I don't think anyone really knows that for sure.

We also see higher blood pressure. Again, higher blood pressure may cost migraine. Or is migraine causing hypertension? We don't know that individuals with migraine have a higher incidence of epilepsy. That's interesting because we theorize that epilepsy and migraine are coded on the same gene.

So the same gene abnormality causes both. We'll talk about medical management of migraine in a moment, and you'll notice that I talk about epilepsy medications for treating migraine. The whole theory behind that, again, is that if they're coded on the same gene, medication that treats epilepsy should also help with migraine. And it does. We also see increased rates of anxiety and depression in those with migraine.

This could be because individuals with migraine are living with a terrible condition that's hard to have. You know, we talked about the impacts on, you know, the work life, the social life, the family life, which are significant. But we've also found that individuals with migraine have lower serotonin levels. Lower serotonin levels are associated with depression. Lower serotonin levels are also associated with increased motion intolerance.

So you'll also find that people with migraine have increased motion intolerance. They don't do very good with motion. They may feel sick or get motion sick, car sick, et cetera. The connection there is thought to be either increased sensitivity to sensory information or lower serotonin in general. All right,

so let's talk a little bit now about vestibular migraine.

This is really where, as audiologists, we're most interested. This is the diagnosis that we may be making. We'll be encountering patients with this diagnosis, in particular in the vestibular clinic, but not always the vestibular clinic. So we have a couple of groups that have attempted to define vestibular migraine. The first being the International Headache Society.

The International Headache Society is the big international group with specialists and headache really from all over the world. So this group is consisted of a lot of neurologists and other headache specialists. This is really considered the original kind of the initial and really the gold standard group for making kind of diagnoses or criteria for diagnosing, diagnosing different headache disorders. So let's look at the IHS Diagnostic criteria for vestibular migraine. First of all, they would want an individual to have a current or previous diagnosis of migraine with or without aura.

To have a diagnosis of vestibular migraine, you had to have had at least five episodes. Now, these five episodes have to have vertigo lasting anywhere from about five minutes up to 72 hours. With half of those five episodes, an individual needs to have one of the a migraine type headache, sensitivity to light or to sound and or visual aura. Now, we'll talk about what they mean by vertigo in a moment because their definition of vertigo through the IHS is a little different than how audiologists approach this. Finally, we have to make sure that these episodes are not better explained by another diagnosis.

So this is really a diagnosis of exclusion for me as an audiologist. That means an individual should have an unremarkable or non contributory vestibular examination. So when I go out and I talk to neurologists about a vestibular migraine diagnosis, I let them know, hey, you need to send that patient to me before making this diagnosis because we need to rule out active ear pathology because that's the other, you know, big thing that causes vertiginous episodes.

Now, a second group that's made a pretty good attempt at defining vestibular migraine and coming up with the diagnostic criteria is a group called the Barony Society. Now, the Barony Society is very different than IHS. This group is made up of vertigo and dizziness specialists. So you have a lot of audiologists, ear, nose and throat physicians, neuro otologists, otologists, neurologists, et cetera. Okay, so this group has a little different slant.

Their, their focus isn't headache, it's more on dizziness. So here's how they propose we should make a diagnosis of vestibular migraine. So at first it sounds fairly similar to IHS. You had to have five episodes with vertigo lasting anywhere from five minutes up to about 72 hours. Again, just like IHS, half of those five episodes should also have a migraine type headache, sensitivity to light or to sound or visual aura.

Now I'm going to describe you the big difference, or probable vestibular migraine can be diagnosed if someone has a previous diagnosis of migraine and the symptoms are not accounted for by another diagnosis. That is very liberal in my opinion. Why is that problematic? That definition by the Barony Society? It bothers me.

I don't like it. Because to make the diagnosis of probable vestibular migraine, an individual only needs a remote history of migraine. That means at some point during their lives, they carry that diagnosis even if they're not currently experiencing migraine. It also says during that, you know, that Barony Society definition, that people should have vertiginous episodes, but they don't have to occur during the migrainous period at all. So the problem here is, might a person have migraine and something else causing the vertigo that we just have not identified yet?

I feel like this makes it too easy to make this diagnosis, which is a problem. When we talk to our colleagues in neurology, they often report that vestibular migraine is the new sort of wastebasket diagnosis in their world. So if a person has vertigo and we don't know why, oftentimes people are just

calling it vestibular migraine and saying, go see a neurologist. When neurologists see these individuals, they say, you know what? These people aren't having migraine, or it's unrelated.

And you're kind of using me as a dumping ground. You know, I often say that vestibular migraine is the new Meniere's disease. As an audiologist, we all know that, you know, there was a time not too long ago where if someone didn't know why someone had vertigo, it was always called Meniere's disease. Well, vestibular migraines become the new dumping ground. So I don't love that.

That barony defin. I think we should stick with the International Headache Society, who really is considered the gold standard.

So let's talk a little bit about how IHS defines vertigo. I think this is important. They say that vertigo can be internal or external. It may or may not be positional. It can be provoked by complex visual stimuli or with head movement, and that vertigo is a sensation of disturbed spatial orientation.

Now, as an audiologist, I consider vertigo the hallucination of spinning, rotational dizziness, whether it be internal or external. Ihs, as I said, calls it a sensation of disturbed spatial orientation. That is a lot more broad than how we use the term vertigo. To me, that could be imbalance, that could be feeling lightheaded or disoriented. So it's important to remember, although IHS uses the term vertigo, it does not have to be true.

Rotary vertigo like we consider it in audiology. They also say the symptoms need to be moderate to severe. What does that mean? Moderate to severe means they interfere or prohibit daily activities, so an individual or patient can't do the things they would like to do during their day because of these symptoms.

Now, how long should a vestibular migraine or A migraine's vertigo last. Now, according to IHS, based on the research, the length of episodes can vary. So they say that in about 10% of people, the episodes may last seconds. Now, that's interesting, because when you look at their diagnostic criteria, they should. They say that the episodes need to last anywhere from five minutes up to 72 hours.

But again, according to their own research, 10% of people have spells lasting seconds, 30% have spells lasting minutes, 30% have spells lasting hours, and 30% have episodes lasting days. Now, you'll see clinically people who have had episodes that last for weeks. It's unremitting and it's terrible. But typically, we expect the really bad stuff, the core migrainous features, to resolve within that 72 hours.

Okay, so let's talk a bit about migraine and its relationship to the inner ear. Now, if we look at some of the data. Now, this data I want to point out, and this is very important, comes from the audiology, ENT, neurotology and otology literature. This does not come from neurology literature. Okay.

There's a huge disconnect, which I'm going to talk about in a moment. But this again comes from the audiology in ENT sort of specialist world. Okay. It's shown in our literature that 40%, 44% of those with migraine have permanent ear dysfunction on one or both sides. It's also been said that Meniere's disease is two times more common in people with a history of migraine.

BPPV is three times more common. Some of the otologic symptoms that go along with migraine can be fluctuating hearing, and that can be in one ear. We can see tinnitus, which can also be unilateral. We also see true room spinning vertigo.

Now that that change in vestibular function can be fluctuating. It's said in our literature to sometimes be permanent, which I have some issues with, or maybe even progressive. Now, it's important if you're a vestibular specialist, that if you're doing an evaluation on an individual with migraine, you need to look at all really of the end organs and both branches of cranial nerve 8. And again, we do that by a

combination of using, you know, cervical vemps, ocular vemps, we can use calorics or rotary chair. We can do VHIT testing to look at each canal individually and compare those tests.

So we really need to pick out where the damage is specifically in the ear when we're sort of analyzing or coming up with Treatment recommendations. Now, one thing I'm sure you all picked up on is that when we talk about fluctuating unilateral hearing loss, fluctuating unilateral tinnitus, and also attacks of vertigo, that sounds a whole heck of a lot like the diagnostic criteria for Meniere's disease, and really, it is. So there could be times, clinically, when you have a patient that presents with those symptoms, and you have to ask yourself, is this individual having Meniere's disease, or are they having migraine? So let's talk a little bit about how we differentiate between the two.

So, first of all, it's important to remember that Meniere's disease is based on symptoms in clinical history presentation, not a specific test. Sure, we have the EcoCHG, but the EcoG is not how this diagnosis is made. If you talk to any neurotologist, they will tell you, I make the diagnosis based on symptoms, and that's really how it's defined. That's how it should be made. With Meniere's disease, we expect there to be fluctuating sensorineural hearing loss.

So bone scores should fluctuate. Typically, that hearing loss is unilateral. Typically, it's low frequency. Again, as you all know, we expect the tinnitus to be unilateral, and it oftentimes has what we call a roaring character, meaning it sounds like a train, plane, or automobile. The vertigo with Meniere's disease should last anywhere from 20 minutes up to about 24 hours.

It'd be very suspicious for a diagnosis of Meniere's to be made if someone's ataxa vertigo lasts less than 20 minutes or over one day. Something else that can be unique to Meniere's disease is unilateral oral fullness. Now, let's delve in a little bit deeper. Now. So how do we differentiate from a symptom standpoint between migraine and Meniere's disease?

Now, Meniere's disease often is accompanied by that oral fullness, which we talked about, which is typically unilateral. Unless a person has this in both ears, that's less common in migraine. Now, I'd like to mention a little point here, and, you know, I taught for quite a few years of a sibilant course for the University of Kansas. And I always told my students, if a person has unilateral oral fullness with their vertigo, tinnitus, and fluctuating hearing, Meniere's disease should be your consideration. But I can tell you I've spent more time recently looking at the scientific literature.

And it's been found that the number two cause of unilateral oral fullness after middle ear pathology and TMJ dysfunction is migraine. So oftentimes individuals with migraine will describe oral fullness or sensation of fullness, pain or discomfort in the ear. So that's interesting. So all those years I taught that in class, it's probably wrong, to be frank with you. With Meniere's disease, we expect her to be unilateral, permanent sensorineural hearing loss over time.

Now, at the initial stages of Meniere's disease, it may fluctuate, it may return to baseline, but over time with continued attacks, you'd expect those bone scores to drop over time. Now, with migraine, certainly fluctuating hearing loss is possible, but it's less likely permanent. We'll talk about why in a moment. Meniere's disease rarely has a hormonal link, so people don't typically have attacks related to Meniere's disease with their menses cycle. Migraine, on the other hand, is highly related to changes in estrogen.

So you'll see migraines come on with puberty. Oftentimes in women, you'll see migraines change or morph during menopause in women. So you'll see in, you know, a dizzy or vestibular clinic, most of your patients are women, you know, during the menopause years. And we see a lot of women in the menopause years because more than likely their migraines are changing, they have a change in estrogen. So the way their migraines are presenting or acting change.

Meniere's disease rarely has a genetic link. The scientific research says that Meniere's disease is not passed down in families. However, migraines absolutely are a final thing I like to throw in. Here is again, when I was teaching, I gave some of my students poor information. And again, I'll admit that now after the fact, I'd always told my students and I had been taught the same thing, that if an individual has vertigo or symptoms related to barometric pressure changes.

So when a weather front's coming through, it's always migraine because migraines are highly linked or provocation of migraines are highly linked to changes in weather or barometric pressure outside. However, there's a lot more data coming out and a lot of good research showing that individuals will also have attacks of Meniere's disease, Meniere's disease with barometric pressure changes. So that's not really something you can use to Define between the two any longer.

So a couple little pearls I'm going to throw in about migraine and Meniere's disease is that both can be caused by outside factors, meaning diet. So we all know that, you know, migraines can be related to. I'm sorry, Meniere's disease can be related to too much salt or too much caffeine or too little caffeine or alcohol, but so can migraine. Meniere's disease can cause drop attacks. So people have drop.

Drop attacks, which is called a crisis to market. With Meniere's disease, we expect there to be a progressive reduction in both hearing and vestibular function, which you rarely see with migraine. Interestingly, when we look at kind of the data with how common both conditions are, migraines occur in 11,000 of 100,000 people. Again, about 1 in 10 people. Meniere's disease is really very uncommon, only occurring in 200 out of 100,000 people.

If we do a little simple division, we'll find that migraine is 54 times more common than Meniere's disease. So, again, if I had a patient coming in with those symptoms of vertigo, you know, lasting hours, fluctuating, unilateral hearing loss, or the perception thereof, or unilateral tinnitus, and I was going to bet on a condition, bet my money, I would bet my money on Meniere's disease every time, just because

the odds would be in my favor. Now, again, as I've kind of mentioned already, both have historically been used as a wastebasket diagnosis. So as good audiologists, we need to be careful and not do that.

All right, So I mentioned earlier that we see BPPV more often in those with a history of migraine. The rate's about three times higher. It's important clinically, if you see a patient under the age of 60 that has BPPV and there's been no head trauma precipitating the onset of the BPPV that you consider migraine as contributory or causal to them developing bppv, the data would suggest that it's very unusual or unlikely for someone under that age to develop BPPV on its own or idiopathically. Okay, so if someone who's young has bppv, migraine should be thought about. If someone also has recurrent BPPV and it's recurring at a rate that considers atypical for your clinic, or you consider atypical for your clinic, you should also consider migraine as contributory or causal to that recurrent PPPV And I'd like to just briefly mention another condition called migranous positional vertigo.

Some individuals with migraine, even if they're not experiencing an episode of migraine, even if they're in that kind of in between period, these individuals may also experience vertigo with positional changes. It could be rolling over, lying supine, just like bppv. Migranous positional vertigo is not caused, however, by an end organ otolithic problem like BPPV is. Migranous positional vertigo or MPV will oftentimes cause vertigo that can last longer than one minute. So remember, BPPV causes attacks that are always one minute or shorter, rarely longer.

If you test an individual with migrant dispositional vertigo, their nystagmus may not indicate a specific canal like you typically see with bppv. Finally, candlelith repositioning will not clear migraine as positional vertigo. So if you treated someone over and over again and they're not clearing, you have to consider migraine dispositional vertigo as causal or contributory. So BPPV in, you know, four or more treatments in my clinic we've looked at the Data is efficacious 99.6% of the time. So if treatment's not working, you've got to consider something else such as this.

Now here's what I consider the most important part of my lecture today. So listen carefully. We need to ask ourselves, can migraines truly cause permanent endor ear damage? Again, this is supported in all of our literature. If migraines do damage the inner ear, how?

We need to ask that question because it's important. We can't just make this assumption without talking about the anatomy of migraine in the inner ear a little bit more. Now, most of the ear related literature, including the audiology literature, hypothesizes that migraines impact blood flow to the inner ear. That impact on blood flow is what's theorized to cause hearing changes and vestibular changes. If you go to any conference, I can tell you when you go to AAA next year and you go to any migraine talks, you're gonna probably hear people say that's the connection.

It's not probably true. And I'm gonna explain why in a moment. I can tell you that if you go talk to many neurologists about migraines causing permanent ear damage, they're going to balk at you. They're going to become very unhappy very quickly because neurologists understand neuroanatomy well. So let's go over our neuroanatomy and our ear anatomy.

Just a little bit more to talk about why there's probably not a connection there. So I'd like to talk a little bit about the blood supply to the inner ear. The inner ear is fed by what's called the posterior circulation system. So at the back of the neck, we have two arteries called the vertebral arteries, which run through the spinal column, through the vertebrae. Okay, they kind of course through the vertebrae.

They join above the spine to form the basilar artery, which feeds blood flow to the brain stem, cerebellum, the inner ear, some of those sort of critical, you know, you know, underlying structures to the brain. Okay? So that blood supply is crucial. That blood supply is what feeds the inner ear. Migraines, on the other hand, are caused by changes in cortical blood flow.

Cortical blood flow would be blood flow that comes from the front. And this blood flow really feeds the surface of your brain or the cortex. A disruption or change in blood flow related to migraine only influences blood on the cortex or outer parts of the brain. Migraines, typical migraines, I should say, do not affect posterior circulation or blood flow to the inner ear. They're anatomically in two very different spots.

Now, there is a rare type of migraine called a basilar migraine that does indeed influence blood flow to the posterior circulation system in the inner ear. But that type of migraine is rare. That's not the type we're typically seeing in our audiology clinics. So again, when you go talk to a neurologist and say, hey, I was at a conference lately, and, you know, we talked about how migraines damage the ear and they change blood flow. So I want you to send me your patients.

A good neurologist will say, wait a minute, that's impossible. Migraines do not change blood flow to the ear, because they can't. And they don't, because we're talking about two anatomical, anatomically different structures. So there's a disconnect there. Migraines don't change blood flow to the ear.

They can't cause damage related to blood flow. It's impossible. In addition to that being said, we need to ask ourselves how. Let's say that blood flow, you know, migraines did impact blood flow to the ear. I mean, they don't.

But let's say that they did. Theoretically. Let's just throw this out there. If they did, could a migraine change blood flow in a way that causes permanent damage to the ear? Well, probably not.

We think that migraines cause vasospasm, meaning an increase in blood flow. Too much blood flow. It's that too much blood flow that causes the headache we experience in the head when we have a migraine. There's too much blood, there's pressure, it causes headache. Is too much blood flow to the inner ear bad?

Probably not. Extra blood flow to the inner ear is considered good. Oftentimes, you know, we'll use medication to increase blood flow to the inner ear with a sudden sensory, neural, hearing loss.

So it's important to know that, you know, migraines or for migraine, let's say that, you know, a migraine did affect blood flow to the inner ear. It's not going to do so in a way that's going to damage the inner ear. All right, so let's say, you know, migraines aren't connected to blood flow to the inner ear. A migraine can't influence blood flow to the inner ear. So why is the ear research showing changes in ear function in those with a history of migraine?

Well, there are a couple of theories which I consider good theories. One is that if you look closely at where migraines originate. So if you do a functional MRI on someone who's actively experiencing a migraine at the very early stages of that migraine, you'll see a misfiring in the brain stem. You'll see a misfiring in the brain stem, and that misfiring spreads, okay? It spreads from the brain stem out to the cortex.

Once that change moves to the cortex, you'll see a depolarization or a change of neuronal discharge. You'll see a change in that homeostatic state of those neurons, and you'll see increased blood flow, too much blood flow, which activates pain sensors. Interestingly enough, though, that little brainstem spot that you see misfiring is probably the causal spot. You know, where migraine originates happens to sit directly beside the vestibular nuclei. So when you see a misfiring in that part of the brainstem, it initially spreads to the vestibular nuclei, which can indeed cause dizziness or vertigo.

So, interestingly enough, I've mentioned this pathway several times. I'm going to delve in a little bit further. Let's talk about the vestibulo trigeminal pathway again. So we found that there's this pathway. There's a connection between a trigeminal nerve and the vestibular system.

There's a reflex pathway. So in the vestibular clinic, we measure the Vestibulo ocular reflex, the vestibulocolic reflex and the vestibulospinal reflex. Those are the three we have tests for. There are other reflexes between the inner ear and other parts of the body. The inner ear happens to have a neurologic connection via the trigeminal nerve to the muscles in the jaw.

We think this, this reflex, at least in mammals, we do know this in mammals. We think this reflex occurs because if your posture changes the way your position, your jaw also needs to change to chew food, basically. So it has to kind of fight the pull of gravity and the muscles need to sort of tweak or change based on your posture or how you're let your standing or swaying. So there is a reflex pathway there. We just don't measure it clinically in the vestibular clinic.

Interestingly enough, migraines do absolutely impact the trigeminal nerve. They also in theory impact this vestibulo trigeminal pathway. So by stimulating the trigeminal nerve in this pathway, migraines can in a roundabout way also impact the inner ear. We also, as I previously noted that individuals with migraine have lower serotonin levels. Lower serotonin levels can impact the inner ear.

Serotonin is found in the inner ear. In particular, it's been studied in the cochlea. And serotonin is considered an excitatory, excitatory neurotransmitter in both the vestibular system and the cochlea. So having lower levels of serotonin can cause issues in the inner ear. It's also possible that individuals that have a predisposition towards migraine also have a predisposition towards developing ear problems.

There could be a common cause, there could be a common gene, there could be something we have not identified yet. So it's possible that one's not calling causing the other at all. People just happen to have both anatomically for an anatomical reason.

So my question is, you know, really if we think about all these different causes I just talked about whether it be serotonin levels, you know, some sort of trigeminal nerve reflex pathway, a predisposition

really in theory, or you know, a brain stem, sorry, a brainstem, you know, sort of originator for, for migraine, that's by the vestibular nuclei. Any of those things in theory though should not cause permanent end organ damage. They really shouldn't. They certainly can affect things and cause vertigo, but it should be temporary. So why does our literature say that individuals with migraine have permanent hearing loss?

And permanent vestibular dysfunction. Why is there a disconnect between that and what's happening anatomically? First, I'd like to say that a lot of our research in the audiology world probably is not great. When we look at migraine, oftentimes in the audiology research, we just call migraine migraine. But as I previously told you, there are a number of subtypes of migraine.

One of those very rare subtypes is basilar migraine. Basilar migraine influences blood flow to the posterior circulation system. Basilar migraines absolutely impact blood flow to the inner ear, which causes permanent damage to the cochlea and vestibular organs. We really should, if we're talking about typical migraine, not include that subtype in our research, because by doing so we're biasing what we're looking at. We're including a zebra, really in our research, and we shouldn't do that.

And the audiology research has done a very poor job parsing out the different types of migraine when we look at our data. I would also say that our research is only coming from a few sources. So when you hear talks, when you look at people's websites, when people talk about migraine, a lot of that information you see published, talked about, discussed, is coming only from a few research sources. We don't have a lot of research in our field looking at this stuff. Again, when you hear this kind of information that migraines can cause permanent ear damage because of blood flow, you need to think a little deeper about this and think about where the source is coming from.

Is this from true science? It's also important to remember that correlation is not causation. Just because individuals with migraine have more BPPV or more ear damage does not mean that migraine is causing

that ear, that ear dysfunction. So let's talk just shortly about how vestibular migraines are managed. Now, really, the gold standard is what we would call medical management.

So this would be using medication. Vestibular migraines are not managed well by abortive medications. Abortive medications are those you take during an attack. So if you wait to take a medication during a migranous headache, it's often too late to stop the vertigo. So they just don't work well.

If an individual has vestibular migraine and the neurologist determines that treatment's appropriate, usually prophylactic medications are the best. These are medications an individual would take every day, forever. You want to stop these attacks from ever happening, ever beginning. And you'll have good control. Now there's some other treatment options that aren't prescription.

There's some over the counter supplements that have been shown to help in the literature which we'll talk about. There's certain triggers and there's also a migraine diet that may help. So here are the over the counter medications that have been shown the most efficacious in the literature. The first is magnesium at a dose of about 400 milligrams. The thought behind magnesium and magnesium is commonly used in individuals with migraine is that it helps inhibit glutamate.

Glutamate is an excitatory neurotransmitter. By inhibiting glutamate you can reduce pain signals and help with blood flow. So that's really the big one that's, that's used in most people with migraine.

Riboflavin or, or B2, they're, they're really this, they're the same thing with two different names. At a dose of 400 milligrams has been shown to help with mitochondrial energy deficiencies, has helped with cellular metabolism and it's been shown to help with migraine.

The final over the counter medication which really has the most science behind it is coenzyme Q10 at a dose of about 300mg which helps with again energy metabolism at a cellular level. It also helps with mitochondrial energy transport. It's also been shown that using all three of these together seems to

really pretty efficacious in the patients come into my clinic, I would say upwards of about 50% have pretty good management just using these over the counter supplements. I also talk with my patients if they're having vestibular migraines about sleep hygiene. It's important for individuals with migraine to get eight hours of sleep at night at least migraines are active more often when people are lacking sleep.

It's also important to have scheduled eating. So an individual with migraine should eat at the same time every day and not skip meals. There's some diet changes an individual with migraine may also make. One is watching caffeine intake. What's funny about caffeine is migraines are related to having too little caffeine or too much caffeine.

So there's probably a sweet spot. Individuals with migraines should avoid drinks with tannins. So drinks with tannins would be red wine, grape juice, anything that's, you know, fruit based with that dark color. MSG should be avoided. MSG is a flavor enhancer that's oftentimes added to Asian cuisine.

You can order your Asian food without MSG. It's added artificial sweeteners. So aspartame, sucralose, etc. Are bad for migraine cured meats and cheeses. So things like lunch meat, hot dogs, ham aren't good.

Finally, pickled foods should be avoided now. So let's talk a little bit about when a neurologist would really consider using a prophylactic medication to treat migraine. Those medications can have had side effects. So most, you know, physicians will consider this thing, these medications with caution. So this is typically when they're prescribed.

So if an individual with migraine has greater than four days a month impacted, if acute therapy or taking medications needed have not worked, if they've used abortive medications greater than two weeks a month, or if they have prolonged aura, typically a neurologist will consider a prophylactic medication. There are several classes that can be used for the abortive medications. Again, these don't work great

for migraine, but I'm going to mention them just for a moment. Some abortive medications are NSAIDs. So those over the counter painkillers like aspirin or ibuprofen or naproxen that are common.

So those, those work as an abortive medication. For migraine, triptans are used. Antiemetics, which means an anti nausea medication, ergots are oftentimes used or any combination of those. The above. If a person has to take any of these more than 10 to 15 days a month, they may have what are called overuse or rebound headaches.

Okay, so here are some of the preventive or prophylactic medications that are used for migraine. Oftentimes antihypertensives are used for migraine. Remember I told you that one of the theories behind migraine pain is that there's too much blood flow in the cortex which causes, you know, activation of some of those pain sensors. So by using antihypertensive medication, you can decrease the blood flow or the increased blood flow. So beta blockers are oftentimes used.

I also talked to you about individuals with migraine having low serotonin levels. So antidepressants are used or SSRIs or SNRI medications. Medications for epilepsy are used and also some Botox is oftentimes used to treat migraine. So let me show you why these medications are used where they affect the brain, because I think this is interesting. So again, antihypertensive are used to decrease that excess blood flow to the cortex.

So what we'll see here is some of these, these medications. So our anti seizure medications, antidepressants are thought to help with that abnormal neuronal spreading of depression, the abnormal neuronal discharge on the cortex. Botox medications are thought to impact that trigeminal reflex pathway. Okay. So they're thought to inhibit that or cause, you know, decrease in overactive activation in that reflex pathway.

Antidepressants work at serotonin at the level of the brainstem or the thalamus. Again, we think there's a brainstem generator. So it's thought that it keeps that little area in the brainstem that's misfiring from misfiring as much as it would. So all those theories behind me to describe, there's a medication for each of those little spots of that pathway, which I think is really, really interesting. Now, a question we might all have as audiologists is we should we refer a patient for vestibular therapy through physical therapy, if they have migraine or for migraine, should we do this?

Well, let's review vestibular rehab for just a brief moment. We need to remember that vestibular rehab is really only indicated in those with stabilized conditions, meaning a condition should have effective management. Okay. Medical management prior to a patient being sent on for vestibular rehab. So if a person's having active migraine, if they're having multiple attacks and the migraines are ongoing, vestibular rehab's not going to work.

You can't have a moving target to rehabilitate if peripheral function is fluctuating or degrading over time. VRT simply does not work very well. Now, it has been shown in the literature that exercise, just in general, it doesn't have to be vestibular specific, does help migraine frequency. I can also tell you that if you look at the data, mindfulness and relaxation can help migraine. So when should you consider vestibular rehab in an individual with migraine?

Well, the whole point of vestibular rehab is to really encourage and speed up the natural central compensation process. It's also there to help desensitize someone to movement or dizziness or help habituate to dizziness or movement. In my mind, we should only recommend vestibular rehab in an individual with migraine if the migraines are medically managed well. Okay. Meaning they're controlled well and the individual still has some ongoing dizziness.

Okay. So if we think they're stabilized because of medical management, at that point, doing a little physical therapy might help okay, it may not help. I would say it's not going to hurt if the migraines are

managed. Well, if a person's migraines are poorly managed, I feel, and I would say the literature supports this conclusion, physical therapy doesn't work all that great. When should we not do vestibular therapy?

Well, if there's a structural issue, okay, so if they have a dehiscence, a tumor, a fistula, or migraine, if there's a central vestibular problem, which migraine is, vestibular therapy has been shown not to help very much. And if there's a compensated ear issue, if there's ear damage, but it's totally better. It's hard for me to recommend vestibular rehab. In my clinic. I have a physical therapist, I employ a physical therapist, but I would be reluctant to send to my physical therapist in these cases.

Now, if an individual has migraine and they also have an uncompensated lesion in the vestibular system, meaning they have not adapted to it, they haven't reached central compensation, then I would probably send on to a neurologist, get medical management in place, and then send on to physical therapy to manage that uncompensated ear damage. Okay, so I've just got a few pearls here at the end. It's important to remember that when individuals have vestibular migraine, the dizziness, the fluctuating hearing, and the tinnitus may not occur during the migraine headache. Okay, so there may not be a temporal association. Vestibular migraines typically start at the age of 38 in women, meaning those vestibular symptoms come on a little later than the headache.

In men, it's about 42. The migraine headaches typically predate dizziness by about eight years. In most people with vestibular, migraine attacks typically last anywhere from minutes up to about 72 hours. The dizziness associated with this is oftentimes what's called vestibular in nature, but that does not have to mean true vertigo. It's also important to remember that vestibular stimulation can provoke a migraine.

So if you bring a patient in for a vestibular evaluation, you do calorics, rotary chair, vhid, any of that stuff, you may bring on a migraine, which may cause dizziness, nausea, etc. It's also very atypical for migraines to start after the age of 50. In fact, a lot of neurologists would say it's probably improbable, if

not impossible. If you have someone in their 60s, 70s, 80s, or 90s who suddenly present with headache. Migraine should not be the initial diagnosis.

That is a red flag for something else going on. They need to see a neurologist and they probably should be imaged now. With that being said, the way migraines present can morph, change, and evolve over time. Meaning if someone had more typical migraines in their younger years and they hit menopause, you may suddenly start having vestibular symptoms that go along with it. Okay, so that can change over time.

Please, as a good clinician, do not use vestibular migraine as a wastebasket diagnosis in your patients. You need to have good information backing up that diagnosis. I also am of the opinion that migraines are best managed by a neurologist. Okay. Please remember that a neurotologist and neurologist are not the same thing.

Migraines are in a neurologist wheelhouse more than anyone else. It's also important to remember that individuals that have dizziness along with migraine, that most commonly they'll occur together. So most commonly you'll have dizziness and headaches at the same time. It's less common for someone to have migranous like headaches and dizziness that both occur but separate in time. It would be considered very uncommon to have no history of headache at all, no history of migraine type aura at all.

About migraine associated dizziness, that would be considered very atypical and it would be an extraordinarily hard diagnosis or link to make.

If an individual has a history of migraine and they're not actually experiencing a migraine at the moment they come to see you, and they have no peripheral involvement, typically your evaluation would be normal, meaning you would see nothing. So if you're between a migraine attack, there's no ear issue.

Everything should look pretty fine. However, if you're seeing a patient during a migranous attack at any stage along that continuum, you may see peripheral type nystagmus, which is horizontal, as you'll remember. Direction fixed, follows Alexander's law.

It's suppressed with vision and enhances dynamically, meaning with with head shake. You can see that you may also see central type nystagmus. So it's kind of a crapshoot what you'll see. You may also see migrant dispositional vertigo.

Okay, so I've just thrown this in my slides. This is the last slide I have in my talk today. I just want to show you how you can kind of go through a diagnosis of vestibular migraine. Using the IHS criteria. So first you'd expect a patient to have a previous or current diagnosis of migraine if you answered yes.

If they then have a vestibular symptoms of moderate to severe intensity and you say yes, if their episodes last five minutes up to about 72 hours and you've answered yes, have 50% of those episodes had at least one of the following, meaning photophobia, phonophobia, visual or headache, a migrator type headache. If you said yes to that, if they've had normal vestibular testing or non contributory vestibular testing, you said yes to that, they probably have vestibular migraine. So those are really the steps that you need to go through in your head if you're going to suggest vestibular migraine clinically. Okay, Now I would like to open things up for any questions that any of you who are live today may have for me.

If anybody has any questions, please feel free to throw them in the chat right now. As of this moment, there are no questions in the chat, but we will wait a minute. Yes, it does not look like there are any questions, so we are welcome to wrap up right now. Dr. Biddle, do you have anything else?

No. I would like to thank you all for your time and attention today. You know, if you're hearing this talk virtually and you have any questions, feel free to reach out to me. I'm happy to talk about vestibular

migraine. You know that whether it be in person or you know, via email.

But I really do thank you. I appreciate your time and yeah, good luck out there. Thank you. And as a reminder, the assessment questions and the evaluation links can be found on the main presentation page. Access through the dashboard section of your account on E Audiology.

Both of these items need to be completed to receive CEUS for the webinar. That concludes our program for today and the Academy thanks you very much for being here.