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Finding Balance: A Discussion of Vestibular Disorders

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Hello and welcome to Finding Balance. My name is Dr. Keeley Layfield and I'm an education and training audiologist here at Starkey and I thank you for giving me an hour of your time this afternoon as we go over some basics about the vestibular disorders and how you can manage them. So this is going to be a jam packed session but you are able to ask questions throughout. If I am not able to get to all your questions before we sign off, don't worry, someone from Starkey will be following up with you. So please feel free to use the Q and A to post your questions and there will also be a PDF handout of the presentation and then you are able to get one CEU credit hour by logging into your audiology online account, going to pending courses and passing the multiple choice exam real quick.

You can see the risk and benefits associated with the with today's course and again this will be in the PDF handout and you also be able to see the learning outcomes. So you should be able to apply basic assessment techniques to evaluate vestibular function in a clinical setting. After today you will be able to develop patient centered management plans and referral strategies after today. And lastly you should be able to identify key symptoms of vestibular disorders or postural instability. So like I mentioned, My name is Dr. Keeley Layfield and on the training team and so let's dive into discussing vestibular disorders so I know we're all probably familiar with this.

Just as a quick reminder, the auditory system is broken down into three main areas of anatomy. The outer ear, which is that pinna in the ear canal the middle ear, which consists of the eardrum and those middle ear bones and then finally the inner ear, which not only has the cochlea and the auditory nerve, but it features the vestibular system as well. So let's briefly review the vestibular system. It's one of the body's primary sensory systems for balance for spatial orientation. Again, it's located in the inner ear and it consists of the semicircular canals and the otolith organs.

The three semicircular canals do detect rotational head movements, while the utricle and the saccule contain oticonia that shift with movement or changes in head position that provide information about

gravity or linear acceleration. Vestibular signals will travel through the vestibular nerve to the brain, where they are integrated with visual and proprioceptive input to maintain balance, posture and stable vision. So for normal function, both inner ears must provide balanced information between the two of them. When the signals are unequal, this is when patients may experience that dizziness, vertigo, or imbalance symptoms. So your vestibular system is working continuously in the background to maintain balance, stabilize your vision, and allow us to move confidently throughout our environment.

So how does the vestibular system contribute to balance? Again, balance is the ability to maintain equilibrium, upright posture and stability during both movement and when at rest. And so this process relies on three stages. Your input, your integration, and your output. The input is when the brain is receiving information from three key systems.

The vestibular system, which again is dictating those head movements and position. Your visual system, which is providing spatial orientation and proprioception. And so this is where you get that feedback from your muscles and your joints about your body position. So together, all of these inputs create a complete picture of how the body is positioned and moving. With integration, all of the sensory information is processed in the brainstem and the cerebellum, where it is compared and interpreted to determine whether the signals are consistent.

And then lastly, we have output. The brain generates a motor response to maintain posture, stabilize your gaze, and keep the body balanced. Balance is not controlled by a single system. It is the result of continuous coordination between sensory input, central processing, and motor output, with the vestibular system playing a critical role throughout the whole process.

As mentioned, the vestibular system contains semicircular canals. And these are three fluid filled tubes, each positioned at about 90 degrees from one another. And so their unique orientation allows them to detect different type of rotational head movements. You have one that's looking at nodding up and

down, another that's shaking head to right to left, and then the other is that tilting right to left. So as the head moves, fluid within these canals shift, stimulating sensory receptors that signal the direction in the speed of movement.

So here you can see, as the semicircular canals are stimulated, the fluid within them will also trigger movement in that corresponding ampulla. Each ampulla is made up of a cupula and stereocilia, hair cells. In a healthy system, sensory input from both the right and the left sides are balanced. So you get that smooth, efficient, dizzy, free movement. When one side is stimulated or excited, the other side is inhibited in, again, an equal and opposite manner.

So all of these have to be balanced for normal function. Now, the utricle is sensitive to movements in that horizontal plane, such as moving forward or backwards. And then your utricle is sensitive to movement in the vertical plane, like going up and down in an elevator. So again, in a normal system, you can see how the utricle and saccule are stimulated in head movements. The hair cells within them are embedded in a gelatinous membrane that contain microscopic calcium carbonate crystals, or deposits, called oticonia.

So when you move, those heavier crystals shift, dragging the gel with them. This will bend the hair cells, sending electrical signals to the brain to adjust your balance and posture. If a patient is moving their head up and down, the saccule will generate signals of movement to the brain, like the utricle will not. This is also true on the inverse or for horizontal stimulation. So the utricle would send signals, but the saccule would not.

In a healthy system, all of this should be equal and opposite for the different signals being sent to the brain. So, in functioning normally, the vestibular system provides automatic balance and spatial awareness by detecting those head movements throughout the specialized sensors in the inner ear. And there are several key reflexes that support this process. You have the vestibulo ocular reflex, or

the vor, and that's what's going to stabilize your vision by generating those equal and opposite eye movements during head motion, which allows us to keep our gaze fixed on a target. The vestibulospinal reflex helps maintain posture and balance by adjusting muscle activity during standing and during movement.

The vestibular system also provides continuous information about head position relative to gravity, supporting spatial orientation and awareness of where we're at in space. In the brainstem and the cerebellum, vestibular input is integrated with visual and proprioceptive information so that we can coordinate smooth movement and minimize those feelings of dizziness and imbalance. So together, all of these symptoms allow us to maintain clear vision, stable posture, and an acute spatial awareness through constant communication between the inner ears, your eyes, your muscles, and your brain.

So now that we kind of know the basics of the vestibular anatomy and how a healthy system works, we need to discuss the different diagnostic tools available if we suspect something not working. So, vestibular evaluation tools assess the inner ear and the brain's balance mechanisms, ranging from diagnostic testing to bedside testing and functional balance scales. So these tools can identify vertigo, gaze instability, and fall risk by tracking eye movements that are often called nystagmus and the vor, or that vestibular ocular reflex.

The vestibular diagnostic testing relies on many different pieces of equipment. You tend to need some type of infrared goggles to track eye movements. These are commonly used in V and G testing. If you're doing VEMP testing, that's going to test that otolith function so that utricle and saccule, and that uses electrodes. If you're doing rotary chair testing, then you do need a rotary chair.

And then posturography is going to assess how patients, you know, use their vision or their touch or their inner ear sensory. So the VNG is probably the most common vestibular assessment that is done in clinics. If they're going to do vestibular assessment. And it can be broken up into three separate

sections of testing. Ocular motor testing, positional testing, and caloric testing.

Ocular motor testing has the patient sit in a dark room wearing goggles, and then they're going to follow dots or a light bar with their eyes, and they're not going to move their head. So this test shows how well eyes track targets, and you're looking for abnormal maladies in those rapid eye movements. So random saccades is where you stare straight ahead and then quickly shift your eyes to focus on something that's appearing randomly, right or left. Smooth pursuit is following that dot or that light on a light bar as it slowly moves back and forth or up and down. And then you have OPK or optokinetic nystagmus that you're testing.

So you're going to fill a screen with a pattern. Think like moving stripes or a checkerboard. And this is going to cause the eyes to continuously drift left or right. And you ask the patient to follow the pattern as it moves. So it's tracking the eyes ability to reset or track rhythmically.

With positional testing, there's a couple of different layers to that as well. So you have static positional. So for supine patient laying flat on their back, sometimes with their head elevated, then we're going to have them laying flat with head turns right and left. And then we're going to do body turns. So rolling their body to the right side, rolling their body to the left side for positional or that dynamic positional testing.

This is where you typically do the Dick's hall pike maneuver. So you move the patient from a seated position to lying flat on their back quickly with her head turned about 45 degrees, and you're looking for nystagmus. You may also do the supine roll test. So have that patient laying flat on their back. Their head is quickly turned from the center to the right and then to the left to again check for nystagmus.

The last portion of the VNG is caloric testing, and this is the most distinct part of the test because it directly evaluates whether each inner ear is functioning properly. You can do this one with water or with

cool air. But you're going to do warm air and cool air and you're going to gently introduce that into each ear canal. The temperature change stimulates those balance organs in the inner ear. And so in a healthy balanced system, this will briefly trigger dizziness and it will cause to move your eyes in a very specific and predictable pattern.

So I love to use the mnemonic of cows, and you've probably heard this one, but it's cold opposite, warm, sane. And so this is referring to that direction of nystagmus that happens during caloric testing. And so what we mean by cold opposite is if you're introducing air or cold air, water, then the fast component is going to beat away from the irrigated ear. For warm, sane, it's, you're going to have that fast phase of that nystagmus beat towards the irrigated ear. So again, cold opposite, warm, sane.

So with your, you know, vestibular testing, we're often differentiating between a peripheral finding and a central finding. So for ocular motor testing, peripheral function is typically normal. So, you know, the peripheral dysfunction is not going to cause issues seen on ocular motor testing. But in contrast, if there is a central involvement to the patient's symptomology, then this is where you'll see impaired pursuits, abnormal saccades, or a disrupted OPK response. For gaze testing and peripheral conditions, any nystagmus is usually able to be suppressed with visual fixation, where if there's a central pathology, the nystagmus typically persists or it may change direction or it could be presented as vertical nystagmus, so you can see some abnormalities there.

For positional testing, peripheral nystagmus typically has a brief latency and it fatigues over time and again can be suppressed with fixation. Central positioning nystagmus often begins immediately and does not fatigue and often cannot be suppressed. And then with caloric testing, peripheral findings are commonly going to show a unilateral weakness, while central findings may present with fully normal responses or a hyper responsiveness. Or again, they can't suppress the nystagmus with a visual fixation. So these patterns are critical for interpretation.

Peripheral disorders often respond well to vestibular rehabilitation, while central findings may require further neurological evaluation and imaging.

Rotary chair testing provides valuable information about the horizontal semicircular canals and the VOR. So this allows for the eyes to make compensatory movements opposite of head motion. And so this can also help patients maintain clear and stable vision. If the patient's VOR is impaired. This is where they may report that oscillopsia or dizziness with head movement.

So rotary chair enhances the accuracy of the vng. And so this is also especially useful in cases of inconclusive V and G result, or if you suspect bilateral vestibular loss or if you're assessing central compensation following a unilateral loss. And so rotary chair is considered the gold standard for diagnosing bilateral vestibular hypofunction. And then posturography is a non invasive assessment used to evaluate how well a patient maintains balance under a variety of sensory conditions. So it measures postural control and helps identify whether deficits are related to your vestibular visual or your proprioceptive systems.

Posturography is useful across a range of conditions. It can help assess vestibular disorders such as Meniere's disease, vestibular neuritis and bppv, as well as identify balance deficits associated with central conditions like Parkinson's or multiple sclerosis. It also can play a very important role in fall risk assessment, particularly in older adults, and can help differentiate whether instability is due to sensory integration issues or musculoskeletal and proprioceptive deficits.

So the SOT or the Sensory Organization test uses dynamic posturography, where the subject stands on a plate, on a force plate and then we objectively measure their postural sway and center of pressure during various testing conditions. So the first condition, kind of your reference, this is, you know, where the subject stands with their eyes open. The second condition, we just remove the visual input. And the third condition, the subject's visual field moves and so this provides a visual input that conflicts with

their other sensory information. In the fourth condition, that force plate is also going to move.

So we're creating a somatosensory disturbance, but the subject is able to still use their other senses to help maintain their balance. In the fifth condition, the subject is deprived of visual input again, only this time so they have to fully rely on their inner ear for sensing. And in the final condition, their visual field moves with the force plate to further conflict with the sensory information coming from the inner ear.

BIMP testing is also a non invasive assessment and this is looking at the otolithic function, so the utricle and the saccule and we're measuring muscle responses to, to sound. So this provides important information about vestibular nerve integrity and is very useful in identifying some specific inner ear disorders. There's two primary types of you have your CVEMP and this One's looking at the saccule and the inferior vestibular nerve. And then the OVIMP is going to evaluate the utricle and look at the superior vestibular nerve. During the test, patients are presented with a sound stimuli and then muscle responses are recorded.

For that cvemp, you're going to have the patient activate their neck muscles while the OVIMP is looking at those eye muscles. This procedure is safe and is very well tolerated and does not typically provoke dizziness from the patient. So clinically, bimps follow a key principle. Conductive hearing losses typically eliminate air conducted responses, while a sensorineural hearing loss typically has minimal impact. VEMPs are particularly valuable in diagnosing conditions such as superior canal dehiscence and and so by isolating otolith and nerve function, the test provides targeted insight that supports accurate diagnosis and management.

And then ecochg, or electrocochleurography is a diagnostic test that evaluates cochlear and auditory nerve function and is commonly used to assess for endolymphatic hydrops that are associated with Meniere's disease. So during testing, the sound stimuli are presented to the patient's ear while electrical responses from the cochlea and auditory nerves are recorded. The resulting waveforms

contain two key measurements, the summing potential and the action potential. So clinically, the SP AP ratio is that primary metric of interest. So an elevated ratio typically greater than 0.35 to 0.4 depending on the lab norms for the equipment that you have.

But again, if you have an elevated ratio, this would indicate increased inner ear fluid pressure and support a diagnosis of hydrops.

And then there's also several bedside tests that you can do that can really help quickly differentiate between peripheral and central vestibular disorders. So you have your head impulse test, your dick's Hallpike maneuver, or the Fukuda stepping test, and then you carefully observe nystagmus associated with many of these tests. It is really important to recognize the patterns in any bedside testing that you do because again, during differentiating between peripheral conditions and central findings is a very important part of the evaluation process. So the head impulse test or the head thrust test has a couple of different names. This is a very quick head bedside assessment that's used to evaluate that VOR or the vestibulo ocular reflex.

So during the test you would tell the patient to fixate on something. I always told them to like stare at my nose and then I would very quickly turn their head. So you want to do a small, rapid, unpredictable head turn. In a normal head impulse test or a negative result, this would suggest a central cause to their dizziness. So in this case, the vestibulo ocular reflex is intact and the remain eyes remain locked on the target throughout the entire movement.

If you get a positive vestibular sorry, head impulse test or an abnormal result, this is indicative of a peripheral deficit. So when you move the head, the eyes move and then perform a rapid corrective saccade. So this test provides valuable insight into vor function and can be a key component of bedside evaluation when differentiating peripheral from central.

The Dix Hallpike maneuver is a positional test used to diagnose BPPV or benign proximal positional vertigo. And it works by moving the patient in a way that sticks stimulates displaced oticonia within the semicircular canal. To perform this test, the patient begins seated near the edge of an exam table. You would Turn their head 45 degrees to one side and then lay them back. And we'll go through all the different components of the Dix Hallpike in just a second.

And then the Fukuda stick stepping test, which is also known as the Unnerberger test, is a very simple bedside assessment used to identify unilateral peripheral vestibular weakness. So during the test, the patient stands with their arms extended, their eyes closed, and you have the march in place for approximately 50 to 100 steps while lifting their knees. So in individuals with a normal vestibular function, they don't really move very much and there's typically very little rotation with their stepping as well. For patients that have a vestibular weakness, then what we typically see is there's rotation greater than 30 to 45 degrees, suggesting again that they're going to have a weakness on one side and they often rotate towards the side with the weakness. So this test can provide a quick functional assessment of that vestibulospinal pathways and can help support findings from other bedside or diagnostic evaluations.

This isn't necessarily a diagnostic test all on its own, but it is a good screener and again can kind of lead you to what other testing do we need to do? Do we also have self reported outcome measures that are really valuable tools for understanding how the dizziness affects the patient's daily life, their daily function and their quality of life. So you have the Dizziness Handicap Inventory, the Vertigo Symptom Scale, the Vestibular Disorder Activities of Daily Living scale. There's a lot of different ones out there, but again, this is looking at how often does this affect the patient. How strongly does this affect the patient, and is there any limitations or weaknesses from this?

Vestibular dysfunction can present with a wide range of symptoms beyond just dizziness. And you will see that patients have a lot of different ways that they describe things, but some common ones that you'll see are vertigo, dizziness, that kind of unbalanced disequilibrium, and sometimes, unfortunately, they have, like, nausea and vomiting associated with these symptoms too. So the most commonly diagnosed vestibular disorders include bppv, labyrinthitis and vestibular neuritis. You know, there may be other problems related to vestibular dysfunction included complications from aging, autoimmune disorders, or allergies. We're not going to cover every single one of these common pathologies today, but I do want to highlight some of the most common ones that you may encounter in your clinic.

And in many vestibular pathologies. Nystagmus is used to diagnose or identify a specific pathology or site of lesion. So nystagmus is that involuntary rhythmic eye movement. So clinically, nystagmus is described by direction. Horizontal is side to side, vertical is up and down, and then torsional has a rotary component to it.

So understanding the types and patterns of nystagmus is key in differentiating, again, point peripheral from vestibular, central vestibular disorders. We talked about BPPV just a little bit, but now I want to go into some more details with it. This is the most common cause of vertigo, and it's characterized by brief episodes of spinning triggered by changes in head position. We jokingly called this the salon diagnosis because a lot of times when I was in my ENT clinic, patients would come in and they're like, I was getting my hair done and they laid me back to wash my hair, and I got crazy dizzy. So benign indicates it's not life threatening.

Paroxysmal refers to sudden short episodes. Positional means the symptoms are triggered by movements and then vertigo is that dizziness sensation. Episodes typically last less than a minute, but they can be pretty intense for patients. And BPPV is a mechanical inner ear disorder, and it is highly treatable once properly identified. So when it comes to identifying bppv, you want to look at what is the

associated nystagmus.

You know, typically, imaging like MRIs is not really effective because the little oticonia that are displaced in BPPV and is causing the symptomology, they're too small to be seen on an mri. So what we do is we provoke the Nystagmus through positional testing and then look at the the movements associated with the nystagmus to know which canal is being affected. You will also see that the nystagmus tends to resolve itself within about 30 to 60 seconds. So it's like once that head movement, you know, initially triggers the movement of the fluid in the semicircular canals and the otoconia, once all that slows down and stops, then the nystagmus stops and oftentimes the symptomology stops.

So to look at which canal is being affected, you want to stimulate the correct canal and then look at the nystagmus associated. And so for that horizontal canal you should see horizontal nystagmus. For the anterior canal you should see down into original or torsional nystagmus. And for the posterior posterior canal you should see up in torsional. Now, the posterior canal is the most common type of bppv.

So again, that's that up feeding torsional nystagmus with the fast phase directed toward the affected ear. The treatment for posterior canal BPPV is the Epley maneuver, which repositions that displaced oticonia through a series of guided head movements. So all the different treatments for BPPV fall under what are called COM or CRM canalith repositioning maneuvers. And again, posterior canal, you're going to do the Epley. So if your patient has right sided involvement, you're going to turn their head 45 degrees to the right, lay them back in that head hanging position, give about 30 to 60 seconds for it to dissolve, resolve, and then move the particles through the canal.

And then that's how you would identify posterior canal and then follow up with that leaf. Horizontal canal BPPV is characterized by strictly horizontal nystagmus. It is most commonly referred to as geotropic, which means that fast phase is going to beat towards the ground. If you see apogeotropic, that fast phase beating towards the ceiling, that is still possible. It is just less common.

You do tend to see that geotropic. You are going to use the supine roll test to diagnose horizontal canal BPPV and you're going to treat it using the barbecue roll or the Lampert maneuver. And this uses a series of 90 degree rotations to again move those displaced otoconia back to where they need to be.

And then the least common form of BPPV is the anterior canal bppv and it's characterized by that down beating torsional nystagmus and this one is most commonly identified using the supine head hang test. And then you're going to treat it using either the SAMONT or the liberatory maneuver. And again, we're trying to get those displaced oticonia out of the affected ear canal. So if your patient has right anterior canal involvement, you're going to have that patient seat with their legs hanging off of, you know, their bed or table, whatever you're using. Turn their head 45 degrees to the left and then quickly lay down on their right side.

Hold that position for about a minute. Don't change their head position. Go all the way nose down to the left. And that's how you would treat right sided anterior canal bppv.

An acoustic neuroma or a vestibular schwannoma is a benign tumor that develops on the vestibulocochlear nerve. And it can carry both hearing and balance information from the inner ear to the brain. So as the tumor grows, it can compress this nerve, which can lead to symptoms such as hearing loss, tinnitus and imbalance or dizziness in a lot of cases. In the majority of cases, the earliest signs are unilateral hearing loss and tinnitus. Now, it's important to note if you see unilateral hearing loss or unilateral tinnitus, that doesn't automatically mean your patient has an acoustic neuroma.

It's just the vast majority of patients with an acoustic neuroma, this is some of the first symptoms that show up. So evaluation for an acoustic neuroma typically begins with a comprehensive audiologic assessment. You want to look at their hearing to see is it asymmetric? And you want to assess auditory nerve function. You may also look at otoacoustic emissions, which can help differentiate cochlear

pathology from neural dysfunction because those evaluate that outer hair cell integrity.

Absent or decaying acoustic reflexes on the effect inside may suggest involvement of the auditory nerve. So again, you want a full auditory assessment. And then the true gold standard in diagnosis is an MRI with contrast because that is what is able to visually see what is going on within the patient's brain.

Now, if you do vestibular testing for an acoustic neuroma, a VNG is often going to reveal unilateral vestibular hypofunction on the affected side. And during caloric testing, the involved ear can demonstrate a reduced or maybe even a completely absent response. So again, reflecting impaired vestibular nerve function due to the tumor compression. Patients may also exhibit spontaneous or Positional nystagmus resulting from asymmetrical vestibular input between the two ears. In larger tumors, oculomotor abnormalities such as impaired smooth pursuits or inaccurate saccades may be present as well, suggesting involvement of central structures such as the brainstem or the cerebellum.

So together these V and G findings can identify both peripheral and vestibular weaknesses and possible central nervous system involvement, which again could guide you towards further evaluation or potentially a referral for an mri. And then treatment is going to highly vary from patient to patient. You know, it may be, let's just observe and see. There may radiation, there may even be surgery to remove, but this is going to depend on a lot of factors such as tumor size, the growth rate, the symptomology, the patient's age and overall health. So early diagnosis supports timely intervention and it can help preserve hearing and balance function and patient quality of life.

Vestibular neuritis is a peripheral vestibular disorder caused by inflammation of the vestibular branch of the eighth cranial nerve. And this will disrupt balance signaling from the inner ear. Now it's important to distinguish this from labyrinthitis. Labyrinthitis involves both the vestibular and the cochlear branches. So therefore symptomology will include hearing loss.

If there's no hearing loss, then this condition should be classified as vestibular neuritis. So patients with vestibular neuritis typically present with acute or continuous vertigo. It's often lasting days. They typically have nystagmus, nausea and vomiting. But again, for vestibular neuritis they don't have auditory symptoms.

So vestibular testing such as the vng, the VHIT and the VEMPS can help localize the site of lesion and confirm the diagnosis as a peripheral vestibular pathology. Audiometry should be included if hearing loss is suspected. So again, if you're going more that labyrinthitis route. In the acute phase, symptoms are present at rest and worsen with movement. And some patients may develop chronic imbalance if full central compensation does not occur.

So vestibular workup typically will reveal a unilateral vestibular deficit. So on the head impulse test the patient will demonstrate reduced VOR gain with that corrective saccade. Pyloric testing will commonly show that unilateral weakness and VEMP testing may show reduced or absent response responses. So for both labyrinthitis and vestibular neuritis, early referral to vestibular rehab is key because this is what helps support central compensation and helps Patient regain their functional balance.

And the Meniere's disease is also called endolymphatic hydrops. And this is a chronic vestibular disorder caused by an abnormal buildup of endolymph in the inner ear. This can begin with episodic hearing loss, can progress to include vertigo, tinnitus, oral fullness. Attacks can be anywhere from, you know, short 20 minutes to several hours or days. And the frequency can be highly variable from multiple episodes per week or months or years in between their attacks or events.

And so symptoms can vary across stages of the disease, which can make diagnosis and management a bit more complex. The Meniere's disease is diagnosed based on clinical history rather than looking at a single test, and is often requiring an evaluation by an ENT special specialist to rule out other

conditions. So a diagnosis requires at least two spontaneous episodes of vertigo, documented low to mid frequency hearing loss and tinnitus or oral fullness. And while there's no cure, treatment focuses on symptom management and reducing the frequency and severity of episodes. The most conservative long term treatment for Meniere's in the US involves adhering to a reduced low sodium diet or using medications to help control water retention.

And vestibular rehabilitation therapy is sometimes used to help with that imbalance that can plague people between the attacks. So we're trying to retain the patient's ability of the body and the brain to process balance information, kind of the goal of treatment. Now, endolymphatic hydrops is a disorder of the inner ear that affects the endolymphatic fluid of the cochlea. But unlike Meniere's or primary endolymphatic hydrops, secondary endolymphatic hydrops has an underlying cause and condition. So, you know, this could be caused from head trauma, ear surgery, something like that.

Symptoms typical of hydrops again are that oral fullness or pressure in the ears, tinnitus, and that dizziness and imbalance.

So diagnosis of secondary endolymphatic hydrops is often clinical. So this is where we're looking at the patient history, physician observation and symptoms pattern. We may also, or like the physician may also order an MRI so that they can get a definitive diagnosis, but it's not necessarily going to differentiate between primary or that Meniere's and secondary. So it's not commonly used. But the treatment of secondary endolymphatic hydrops is a little bit different from Meniere's because again, secondary endolymphatic hydrops is secondary to an underlying disorders.

And so rather than, you know, occurring in Spontaneous attacks. If you can identify the underlying disorder, you can treat that. And then that does tend to manage better symptomology for the secondary endolymphatic hydrops.

So when it comes to, you know, trying to differentiate between the two, you know, audiometry is often going to reveal a low frequency sensorineural hearing loss. In both. EcoCHG may demonstrate an elevated SP to AP ratio. In both, BNGs may show very similar results. You get that caloric weakness on the affected ear.

The primary distinction between the two is again, is there an underlying cause or not? And so this is where you may rely on that MRI with contrast blood work or the patient's medical history.

Now, as hearing healthcare professionals, we may not routinely manage vestibular disorders, but we frequently, frequently care for patients who are at an increased risk for falls due to the strong relationship between hearing loss and balance function. By the time that many patients seek help for hearing loss, they've already kind of begun adapting their daily activities or limiting, you know, their environments that they're in or limiting their mobility. And all of this can lead to a higher risk of falls. So I talked about the SOT test or that sensory organizational test early on. And in a 2019 study from Tel Aviv University, they wanted to kind of look at how much does hearing contribute to balance?

And so what they did was they tested adults with normal hearing, both with and without earplugs, to create a temporary conductive hearing loss while leaving vestibular function unchanged. And so when auditory input was reduced, participants showed a significantly poor balance performance, particularly during that sought condition four, which is one of the most challenging test conditions. And so these findings suggest that hearing may serve as an additional resource for sensory information for balance, again contributing to spatial awareness and postural control.

And research continues to demonstrate the strong relationship between hearing and balance. One large retrospective study found that increased hearing loss was associated with greater postural sway, even after controlling for factors such as age, sex and vestibular disease. Specifically, for every 10dB increase in hearing loss in the better ear, it was linked to an approximate 6% increase in postural sway

during balance testing.

And a fall can very quickly trigger a cycle of decline, which makes early intervention especially important. For many older adults, a serious fall can be a major turning point, often leading to hospitalizations, reduced independence and poor long term outcomes. And so you can kind of look at some common fall risk factors. Now, the non modifiable ones, of course, we can't do anything about their non modifiable. We can do stuff about the modifiable ones.

So you know, this is looking at a patient's gait, their balance deficits, their lower extremity weakness, are they on specific medications? Are there hazards in their home? Do they have orthostatic hypertension? Again, all of these can further increase their risk of fall. So by trying to, you know, mitigate where you can, you can identify and address the modifiable risk, which will also allow you to implement targeted evidence based interventions to reduce falls and improve patient mobility.

Also rely on your visual observations. Fall risk screening starts the moment you see your patient in the waiting room. Look for those signs. Are they frail? Do they walk slow?

Are they using a walking aid? Do they shuffle their feet? Are they constantly bruised because they're falling into things? You know. These quick observations provide valuable insight and can help identify patients at risk.

And the CDC developed a fall prevention initiative called steady, that's that stopping elderly accidental death and injuries. And it's a program designed to help us identify the modifiable risk factors in an individual patient. Now the study toolkit provides a wide range of resources both for you, the clinician, to make fall risk screening and management easier to implement in your clinical practice. They also have resources for patients as well. So this is something that is definitely well worth exploring if you're looking to add this.

And then depending on the patient's presentation of their symptomology, additional referrals may be a very important part of their comprehensive care plan. So working with primary care providers help coordinate further evaluation and management when needed. Pharmacists are a huge valuable role, especially for those patients that are taking multiple medications. And then there's also a lot of different community based programs. And you know, I've talked about the steady, but the Otago Exercise program is a good one to look at.

So the National Council of Aging has a really good resource list for things like that. But a very common referral that we as audiologists make is for vestibular rehabilitation and that's that specialized form of physical therapy to reduce dizziness.

Now we've looked at a lot of different disorders and their impact on fall risk, but let's put this into practice and work through a clinical case study. So James is a 58 year old patient who is presenting with a complaint of I constantly feel off balance, like I'm swaying or walking on a boat. He unlike brief positional vertigo, this type of persistent imbalance and oscillation suggests a different underlying process. So he has a three week history of persistent imbalance that began following a severe cold. He denies true spinning Vertigo, but more of that like unsteadiness while walking.

And his symptoms worsen during quick head movements or with visually busy environments. He denies any hearing changes, he denies tinnitus or ear pain or any neurological symptoms. And he does report that he's had one recent fall which occurred when he turned really quickly in his kitchen. So otoscopy was unremarkable. His hearing was within normal limits bilaterally.

The dick's hallpike was negative bilaterally, but during the VNG we saw a 25% left side unilateral weakness. And positional testing revealed mild persistent right beating horizontal nystagmus. So both of these confirm that reduced vestibular function on the left side, more than likely secondary to

vestibular neuritis, since there was no hearing symptomology. So for James, we ended up referring him to vestibular rehabilitation and we educated him on compensation strategies and fall prevention. And so he came back for his six week follow up and he reported improved stability and confidence with walking.

And so he did have some mild symptoms persist with rapid head movement. So he is going to continue VRT a little bit longer now there. I want to just shift our focus a little bit right here at the end before we wrap up on how technology can help support patients directly. Starkey offers several tools designed to promote safety, mobility and independence, including our fall detection tool and solutions that are designed to assess and improve balance. So we've got our balance assessment tool so that patients can see are there specific areas of weakness that they should be concerned about.

And then we have our balance builder tool that allows them to take those identified weak areas and strengthen them up. So all three of these are possible because of our sensor technology that we introduced in 2018. We have a gyroscope and an accelerometer on board our wireless hearing aids, which are going to detect those rotational movement as well as velocity changes. And so these sensors have been instrumental in accurately detecting how that patient's moving. So this allows us to use those in those health and wellness features.

So practicing at the top of our scope begins with understanding the full impact of hearing and balance disorders and ensures that we have the knowledge and the skills to address them effectively. The patients we serve, you know, often face increased risk for falls, social isolation and cognitive decline. So as hearing healthcare professionals, we have a very important opportunity to recognize these risks, educate our patients where necessary, and intervene in meaningful ways throughout that journey. Again, Starkey is here to support you as best as we possibly can so that you can help your patients hear better, move better and live better. There are tons of resources.

I've mentioned some already throughout the talk, but I just want to mention these a little bit right here at the end because again, there are resources for both clinicians and patients. The American Academy of Audiology recently published an Audiology Today article in January of this year, 2026, outlining best practices for managing vestibular patients. And then organizations like the Vestibular Disorder association or VIDA provide comprehensive, patient friendly materials on vestibular conditions and treatment options. Starkey also has a lot of resources around our fall and balanced tools and we even have a really cool balance brochure for patients. And so you can find all of these on starkeybro.com or you can reach out to your sales rep. Now I covered a ton of information today and so if you want a list of resources, this is also in the PDF handout that you can find in the chat.

But this is just a link to all of the research and images used throughout today's talk. And so I thank you all for giving me an hour of your time. And so, oh, I do see a comment that someone said the Dizziness Symptom profile by Vanderbilt is a very helpful tool. Great call out. Thank you for mentioning that.

For everyone, that is a great resource as well. So I don't see any questions. So with that, thank you guys for joining me today. I hope this session provided practical insight that really help you apply vestibular workings into your daily clinic. So thank you.