

John Marinelli:

Hey, everybody. Welcome back for another episode of ENT in a Nutshell. My name is John Marinelli, and today we're joined by laryngologist Dr. Greg Dion to discuss unilateral vocal fold paralysis. Dr. Dion, thank you for joining us today.

Dr. Greg Dion:

Absolutely. As always John, it's a pleasure to be here and contribute.

John Marinelli:

I think sometimes as a resident been confusing when I read various literature on this topic. There's several different words used to describe paralysis, paresis, immobility, hypomobility. Could we just start with a brief description of this different terminology?

Dr. Greg Dion:

For sure, absolutely. I like how you want to dive right into the controversies. Don't pull any punches here. I think the best way to think of it is, what do we see and what do we say? What we see is mobility. We'll see vocal fold immobility, which is obviously non-movement, and that could be from any number of causes, mechanical or neurologic. You could have something like crico arytenoid joint fixation causing immobility, as well as something like paralysis.

Dr. Greg Dion:

And then you have hypomobility, which as we know means it moves, but not quite normal. And so that's this partial movement. And interestingly enough, that also can be from paralysis because you might have other entrants like laryngeal muscles allowing movement in the setting of paralysis. When we think about immobility and hypomobility, we're really talking about what do we see.

Dr. Greg Dion:

And then, the traditional terms of paralysis obviously is referring to nerve injury not permitting motion of the vocal folds, and then paresis as that nerve weakness. There is quite a bit of controversy around these and semantics involved, but the reality is understanding as a resident, and the broad overview is if we understand what's happening in the setting of immobility, hypomobility, paralysis and paresis that really helps set the framework for our discussion today. I'm glad you threw out that easy one first.

John Marinelli:

Of course. Yeah. Just transitioning then to patient presentation. How are these patients typically presenting?

Dr. Greg Dion:

Yeah. Well, this is really fascinating because this extends across essentially all parts of otolaryngology. This could be kids, this could be adults, it could be patients in neurotology clinic or obviously a laryngologist or a head and neck surgeon. In this case, just like with most things, we want to say where did this referral source come from? Is this a patient being referred from general surgery after a thyroidectomy or something? It gives us some sense of where these may have come from. Or was it somebody who underwent a chest surgery and that helps us out.

Dr. Greg Dion:

Additionally, some of these patients can be entirely asymptomatic or they could have significant dysphonia or dysphasia bringing them into the clinic. Interestingly enough, in the past year, our Academy, American Academy of Otolaryngology-Head and Neck Surgery, put out a new clinical practice guideline specifically on dysphonia, and given all of the potential things that could be a problem that are significant, if a patient's seen by a primary physician or a gastroenterologist or another provider, and doesn't appear to have improvement in this voice over about four weeks timeframe, or if there's a concern for serious underlying causes, they should get visualization with laryngoscopy. That's a common source of referral nowadays.

Dr. Greg Dion:

It's also important to consider, like I had mentioned, where do they come from? Are we thinking about an iatrogenic injury or was there airway manipulation from being intubated or are they being sent for an upper respiratory tract infection with a cough and dysphonia? I think a lot of these things, especially with the publication of the new clinical practice guideline, will influence the type of patient that shows up. But because of the fact that malignancies can also present this way, especially in patients with a history of tobacco and alcohol use or a history of another cancer, it's really important that we're in tune to this in patients referred for a hoarse voice, new onset dysphasia as well.

Dr. Greg Dion:

That's kind of a broad overview that these patients. Could be any age from infant through elderly, but I think you really have to look at those new patients coming in hoarse to sort it out.

John Marinelli:

And you just mentioned a little bit about malignancy. When we think about differential diagnosis, if we could go to that next, could you touch on first maybe the different malignancies or how to think about that in this context?

Dr. Greg Dion:

Yeah. I like the kind of way that you're laying this out. We have general things, like you said, that could be malignancies. We could be talking about heterogenic or neurologic, et cetera. And so looking at malignancy is a great place to start. Obviously you could be talking about a laryngeal tumor, a primary laryngeal tumor that could be a giant cell tumor. It could be a squamous cell carcinoma of the larynx most commonly affecting the vocal folds vibrations in the voice. That's clearly why a lot of these people referred.

Dr. Greg Dion:

That being said, the role of extra laryngeal tumors in causing dysphonia is not insubstantial. When we think outside of the larynx, what could cause someone to be hoarse, a common one, really probably the most common is a lung tumor. If you have a tumor in the upper lobe of the lung, particularly on that left side, it's going to end up compressing the nerve and you get a unilateral vocal fold paralysis. This is very commonly seen.

Dr. Greg Dion:

You may have primary esophageal tumor. In the setting of an esophageal tumor, remember that the recurrent laryngeal nerve runs in that tracheoesophageal groove. And so if that is compressed or twisted or even involved, then you could get impact of the nerve either via compression or invasion, and as a result, reduce function.

Dr. Greg Dion:

It could be a thyroid malignancy that has grown causing compression. Your thyroid sits in that region.

Dr. Greg Dion:

Medial sternal tumor. Any of these medial sternal tumors, when we think about the course of the recurrent laryngeal nerve puts that at risk for compression or invasion.

Dr. Greg Dion:

And then all the way up into the skull base, we can have skull based tumors that we deal with as the laryngologist or a neurosurgeon colleagues that can cause compression on this nerve, and as a result, end up with vocal fold immobility.

Dr. Greg Dion:

These are very, very important things and really should be the first thing on the mind that you want to rule out. I do like that you kind of lead with that because when we think about these, this is really the reason these patients are... a lot of them are initially referred. When you think about the patient, their first thought when their hoarse and it's not going away and it's not from a cold is do they have some kind of cancer? And there's a lot of cancers that can end up not only intrinsically in the larynx, but these extra laryngeal tumors causing unilateral vocal fold immobility. That's a great place to start and very important to rule out.

John Marinelli:

And what about iatrogenic causes?

Dr. Greg Dion:

Yeah. So, iatrogenic causes are very common. It's not uncommon at all as a laryngologist or an otolaryngologist to get a referral for a patient who's undergone some kind of procedure. So, we can break this down a couple of ways. Looking at things that we're not thinking that the nerve itself was traumatized surgically, would be patient maybe was intubated for some kind of belly procedure or some orthopedic procedure.

Dr. Greg Dion:

And upon extubation, they're found to be really hoarse. It doesn't improve for a while. They're sent to the otolaryngologist. You visualize the larynx, finding unilateral vocal fold immobility, and there's a number of things that could cause that. So immediately afterwards, it could be cricoarytenoid joint subluxation. Right. So, you have your arytenoid subluxation. It could be that there was pressure in the sub-glottic region, which is compressing the area where the recurrent laryngeal nerve enters the larynx. And that could cause a unilateral vocal fold immobility, a more common suspected reason, is so that's something we would further work up.

Dr. Greg Dion:

But when you mentioned iatrogenic, I think traditionally people are thinking like, wow, was the nerve injured during a surgical procedure to the neck or upper mediastinum. So again, that goes to what did the patient undergo? So if they underwent a mediastinal exploration for a biopsy or a removal of a mass by a cardiothoracic surgeon in those areas or a heart surgery. Certainly especially on the left, when we think about that recurrent laryngeal nerve course, that nerve is at risk.

Dr. Greg Dion:

And so, it can be a number of things. You could have thermal damage from during surgery, from a Bovie or another thermal instrument. The nerve could be severed partially, entirely. The nerve could be compressed or in a retractor. And so that can be problematic.

Dr. Greg Dion:

Thyroid surgery is obviously another one that we all think about. So it turns out that it's not that common after thyroid surgery, but when you start thinking about the number of thyroid surgeries done, even uncommon things done in large, large numbers end up happening so we see them.

Dr. Greg Dion:

Then we move on to another common thing, especially in the current day and age, is cervical spine surgery by neurosurgeons or ortho spine surgeons. And in that case, we are talking about maybe two to 7% that end up with some sort of a vocal fold weakness or immobility after that surgery. And then we could also have anyone who undergoes any kind of esophageal surgery and esophagectomy for a cancer or something along those lines. Any neck surgery that we can think of, again, especially around the area of the tracheoesophageal groove could cause issues for vocal fold immobility.

Dr. Greg Dion:

So those are the main kinds of iatrogenic injuries from surgery. And I guess we could expand iatrogenic, so to speak, in terms of trauma. Being a victim of a gunshot wound, so stabbings to the neck and those that may involve the course of the recurrent laryngeal nerve. Or even the cavitation caused by that bullet traversing the neck could cause nerve damage, neuropraxia, that then results in unilateral vocal fold immobility.

Dr. Greg Dion:

So if we think about, in some sense iatrogenic because some projectile, could be a machete, could be a knife, could be a bullet, that has traversed that area. And either disrupted or the edema from that in the region has caused impact on the nerve. So those are also common reasons that a patient can have unilateral vocal fold immobility.

John Marinelli:

And you mentioned previously neurologic ideologies. Could you touch on that as well?

Dr. Greg Dion:

Yeah. So interestingly enough, the term neurologic fits a lot of what we're talking about because compression of the nerve or partially cutting the nerve, technically those are nerve issues. But from a

broader context, it's possible somebody who had an infarction of the PICA could lead to vocal fold paralysis.

Dr. Greg Dion:

You can have any of these etiologies that affect the motor nucleus of the vagus and the medulla or the nucleus ambiguus, multiple sclerosis, ALS, these could all affect and impact somebody having unilateral vocal fold immobility.

Dr. Greg Dion:

If we think about even Arnold-Chiari or Dandy-Walker syndrome, as we compress different areas, we can end up causing impacts on the recurrent laryngeal nerve. And as a result, have vocal fold immobility. So these are all things that you consider in your workup and for your differential, if you haven't found anything else. Make sure we're working out what's going on from a more global neurologic perspective.

John Marinelli:

And I know, we could obviously go on for hours with this, but a couple of other high yield ones I wanted to ask you about. Other causes like systemic disorders or toxins or infections. Anything else worth mentioning there?

Dr. Greg Dion:

Oh, certainly. I think systemic diseases can be significantly problematic. When we think about, especially auto-immune stuff. We start talking about rheumatoid arthritis, someone with severe rheumatoid arthritis can develop crico-arytenoid joint fixation. In that case, you're going to have an immobile vocal fold related to a systemic disease.

Dr. Greg Dion:

Other things that have been linked has been sarcoid and there's some thought that people's immune systems are depleted in diabetes. And so all these things should be considered when you're working it up. In a broader context, one of the things we haven't mentioned, which is very, very common is idiopathic unilateral vocal fold paralysis. Meaning that we don't really know what the reason is. Conceptually the thought is that there's potentially a small viral prodrome or there's a small viral impact on the nerve in which it's causing unilateral paralysis or paresis. Meaning you're going to see hypomobility or immobility, that we generally follow to see at what level is that going to improve.

Dr. Greg Dion:

And those numbers vary depending upon whose data you read and what the literature says over the years. I mean, that may be as much as 75% recovering or turn that around and saying a lot of them don't recover. I think a lot of that depends on electromyographic patterns and other information, but linked in with the concept that in some cases, people believe that the idiopathic is linked to a viral prodrome or a viral syndrome. We could talk about other infectious links. And there's some question of TB generally in the complex of a tuberculosis affecting the lungs and that inflammation impacting the recurrent laryngeal nerve. Or Lyme disease based on the pattern of how Lyme affects the body. Or even something like syphilis has been...

Dr. Greg Dion:

Just the sake of completeness. There's some question of heavy metals such as lead or arsenic, though that is far less common. So I think, the way you went through our differentials was really thoughtful. Right. We started with rolling out malignancy, most important thing. That's generally why a lot of these people are referred. Then we look at, have they undergone a procedure for an iatrogenic injury or a trauma. Moving then into the more nuanced diagnosis of neurologic conditions, infectious systemic diseases, or to the idiopathic.

John Marinelli:

And in terms of pathophysiology, how do all these things work together to end up manifesting in the clinical presentation that we discussed earlier?

Dr. Greg Dion:

Yeah. I think without doing too much of an anatomy deep dive, overall when we talk about the larynx, we're thinking about the cricoid thyroid cartilage relationship with the arytenoids sitting on top of the posterior ring of the cricoid cartilage, rotating and sliding forward and backwards.

Dr. Greg Dion:

Specifically, how these muscles that control that motion interact with the nerves. So, if we think about our intrinsic muscles of the larynx, we're going to talk about a recurrent laryngeal nerve, innervating the PCA and the inner arytenoid. So generally speaking, though, there are a number of innervation patterns outlined and described to date on the branching pattern of the recurrent laryngeal nerve as it enters the larynx.

Dr. Greg Dion:

In general, accepted to be that posterior branch of the recurrent laryngeal nerve as it enters the larynx, innervating the PCA posterior cricoid arytenoid muscle, which is the only muscle that abducts. Means opens the larynx and opens the vocal folds. And the inner arytenoid muscle, which is actually bilaterally innervated, and the only muscle as such.

Dr. Greg Dion:

So, if we go with probably the most common branching pattern of the recurrent laryngeal nerve, although note this may vary between individuals, you also innervate the vocalis muscle, thyroarytenoid muscle and lateral cricoarytenoid muscles. So, those are all the muscles that in some way, shape or form or grouping, could be impacted in the setting of something impacting the recurrent laryngeal nerve.

Dr. Greg Dion:

And then, when we talk about the superior laryngeal nerve we have the internal branch which gives the sensory input. And then you have the external branch of the superior laryngeal nerve, which innervates the cricothyroid muscle. Is what allows our cricoid cartilage and thyroid cartilage to interact, lengthening the vocal folds, increasing our pitch, providing additional information.

Dr. Greg Dion:

So, with these numerous muscles and structures contributing to the complex production of phonation in the human, you can imagine or envision how there are many ways that you could end up structure, altering or impairing mobility. This is a small area. So, if you have vocal fold mobility.

Dr. Greg Dion:

So from a very simple standpoint, you can start with the framework. You could have invasion of a local tumor of some sorts into some surrounding multiple muscles that are innervated or are invaded by a tumor that could create issues with rotation of the arytenoids or impact their overall pliability and structure, which would change voice and cause it to be hoarse, or potentially immobile. Then more commonly from what we're thinking about, outside of just a structural space occupying tumor, would be anything that impacts the nerve.

Dr. Greg Dion:

And so, you could envision from just looking at this how the nerve could be impacted far away, meaning at the skull base or anywhere along the course, extra laryngeal. And that's going to impact all of those muscles. So if it's at the skull base with the vagus, well now you could have recurrent and superior laryngeal nerve paralysis versus having one or the other affected, depending upon the type of injury.

Dr. Greg Dion:

And then furthermore, if you start thinking about something closer to the larynx. So in some cases, this branching pattern of the recurrent laryngeal nerve actually occurs outside of the larynx. And so maybe only one of those branches was impacted by an injury or something else. So, there's a lot of ways to consider it.

Dr. Greg Dion:

Traditionally, the SLN paralysis outside of a broad vagal injury, which impact both, especially at the skull base, and isolated SLN injuries. Typically thought of conceptually as something that might happen after a thyroid surgery, where a patient comes in with perhaps they have trouble with their voice, meaning when you deep dive into what that means to them, they can't modulate their pitch as they once did. Or perhaps, maybe there's some sensory issues because sensory innervation with the superior laryngeal nerve.

Dr. Greg Dion:

So, from a pathophysiology standpoint, you're talking mechanical. Right. So any mass or structure. And then from a nerve standpoint, it gets pretty intricate pretty quick because if the nerve was crushed and, or severed, how does it come back? Did all the nerve fibers come back? Only some of them? Do you get regular innervation, neuropraxia? Do you end up with synkinesis in the setting of a severed or partially severed nerves? There's lots of things that could relate and become problematic.

Dr. Greg Dion:

For example, a severed nerve that is either still close by or partially cut. Interestingly enough, your recurrent laryngeal nerve innervates both the muscles that open and close the glottis for your voice production. Well, if those become misaligned, you're going to get synkinesis and immobility regardless if the muscle was completely cut. And then, from a broader standpoint, if you were talking about overall heavy metal poisoning or another infectious etiology, you could be impairing nerve conduction or overall bodily functions.

John Marinelli:

Transitioning now to workup, we've talked about presentation, differential diagnosis, and now pathophysiology. Maybe just starting with history and physical. We've touched a little on history already, but anything else you'd like to add to that? And then how do you think about the physical exam?

Dr. Greg Dion:

Yeah, I think this is maybe the most important part to really sit down and discuss and think about. Not only in terms of how do we get to an answer, but also a thoughtful approach to the patients. And one of the first things you do when you meet a patient is you're going to introduce yourself and having some basic salutations.

Dr. Greg Dion:

And so, in a really not prompted context, you're able to garner some information about that patient's voice. And really assess their perceptual voice quality in a natural, conversational tone, rather than the number of tests that we're going to prompt the patient to do. And those prompted tests can alter laryngeal biomechanics and dynamics in such a way that may mask or alter what's actually happening.

Dr. Greg Dion:

So, just the act of sitting there, talking to the patient, you're going to see if they need to take multiple breaths to finish a sentence. You're going to see if they're hard to hear, and they have a breathy quality to their voice. Or perhaps you end up with diplopia where they have actually two frequencies simultaneously based on the vibratory pattern.

Dr. Greg Dion:

So, just that very first portion of the introduction, you're really acquiring a lot of information. And it's going to help drive what you're thinking in terms of what may have happened. What's going on here? And also, how is this impacting the patient? A lot of times, we were trying to make a diagnosis and score a home run in terms of a treatment plan, but understanding how this is impacting a patient is really key.

Dr. Greg Dion:

When you're doing that history, while you're listening carefully, you're going to go through your history to eliminate all those things we talked about, like heavy metal exposure, systemic diseases, recent infections, recent surgeries, risk factors for malignancy. Now, moving into the physical exam, some of the things you might see to help narrow things down would be if you're suspecting a high vagal injury, the palate will elevate to the opposite side, meaning away from the site of injury, so that could be something you would notice. Some other things would obviously be surgical scars or something. Then in a large context, you're going to see is the patient sitting there with large, broad knuckles, or fingers curled up, or kyphosis from rheumatoid arthritis. You're going to be able to pick up on those in your overall discussions with the patients.

Dr. Greg Dion:

Other things you're going to collect at the time would be some basic voice data. We could do a maximum phonation time. That's when you're going to have the patient take a deep inhalation and then sustain a steady vowel sound for as long as possible. And so, what we're looking for there is that, in general, 15 to 25 seconds in women and 25 to 35 seconds in men would be our normative values. And so if you're finding that the patient is just immediately losing air, which is really not uncommon in that



unilateral vocal fold paralysis situation, five seconds later they've expired all their air and they can't sustain the vowel sound anymore. It's really going to help point you in the direction. Those tasks, without really using any instruments or tools, are very, very valuable.

Dr. Greg Dion:

There's a number of other things that I think are really important to collect, and that would be the subject of voice quality. You could use the Voice Handicap Index, or the shorter version, the Voice Handicap Index-10, the validated surveys that really allow you to understand how this voice issue's affecting the patients. Because if they come back and say like, "Yeah, I might be hoarse but it doesn't impact me," that's going to alter not necessarily your diagnostic approach, but potentially your treatment approach. So these are really key things to understand, as a surgeon, as you approach the patient.

John Marinelli:

What about laryngoscopy here, and videostroboscopy?

Dr. Greg Dion:

Yeah, we mentioned early on that, as illustrated in the recent clinical practice guidelines and as well as common sense, patients showing up that have been hoarse, particularly for weeks on end by the time they get to a laryngologist or an otolaryngologist, you need to visualize the larynx. What are we looking for there? Traditionally, we did the mirror exam so people could see, but really you want to assess a couple of things. First and foremost, you want to assess basic mobility. Are we seeing vocal folds move, just not as good as they used to, or incompletely, or are we seeing complete immobility on one side, versus immobility on the nerve side, which is a discussion in and of itself.

Dr. Greg Dion:

We're going to look and say, okay, do we have a unilateral vocal fold that doesn't move as symmetrically as the other or maybe it doesn't move at all? Or circling back to an early iatrogenic issue, is this patient maybe even a little short of breath and being seen right after being extubated and you scope them, you look down and you've got this forward rotation and you can see the arytenoid has kind of fallen off the cricoid cartilage and essentially into the airway, suggesting arytenoid subluxation. Those are the things you're looking for. After you're able to assess basic mobility based on your initial laryngoscopy, you can decide what to do next.

Dr. Greg Dion:

There's been this concept years ago that, well, where the immobile vocal fold lies tells me where the initial lesion was. If you really start reading into the literature, this also is a little bit of a controversial topic. It's possible for a number of etiologies to end up in the paramedian or cadaveric position. I think that although traditionally we've wanted to be able to look at a larynx and say, "Hey, I see how that vocal fold looks, I know where the lesion is," I think there's enough evidence to suggest that that might be a bit aggressive to say that we can do that. But noting the position of what it looks like is key.

Dr. Greg Dion:

Now, the other thing we can get involved in is videostroboscopy. I think the role of videostroboscopy in the setting of vocal fold immobility can't be understated, because we can collect all kinds of information. We're going to look at the specific waveform of the vocal fold to look for what's that mucosal waveform.

Is there asymmetry in that waveform or perhaps a decrease or later vibratory onset suggestive of the vibration on the intra side being kick started by the airflow velocity and motion on the other side? Also, you're going to see maybe a decreased velocity in that ipsilateral vocal fold where your injury is or your mobility is that can help your visualization of motion of the larynx, as well as you're employing videostroboscopy copy to make a thoughtful plan moving forward, are really key topics.

John Marinelli:

What about EMG, any role for that here?

Dr. Greg Dion:

Yeah, yet another one of those can of worms you want to open. Electromyography can be really helpful in some circumstances, however, nothing is without its drawbacks. Some of the issues around electromyography is that it is extremely dependent on both the electromyographer, be that an otolaryngologist or a laryngologist or be that a neurologist that specializes in electromyography, reading the signals, as well as the needle placement. You have to imagine that if that needle placement is just a millimeter or two off of one of the muscles, either the LCA muscle, PCA muscle, vocalis, TA or CT muscle, you're going to get aberrant information. Then even in the setting of results suggestive of, say, polyphasic potential suggestive reinnervation, it's possible to then not have recruitment of those muscles and really not have an improvement longterm.

Dr. Greg Dion:

So there are certainly proponents for it, and with good reason, in the correct setting with the correct people, with the correct training. That being said, it's also possible that a lot of situations, it has limited utility. Especially in patients who have already undergone a bunch of procedures, it is a procedure for them to undergo. It is worth considering mentioning, and depending upon your individual situation, availability of equipment and expertise can be employed, but it may or may not fit into the process.

John Marinelli:

And any role for imaging here?

Dr. Greg Dion:

Yeah. So, imaging also big broad topic. Upfront, some of the quasi-clinic imaging would be like a video fluoroscopy, so depending upon your setup, this might be nearby, this might be done in the radiology suite. And that's the chance to assess any chance of aspiration. One of those things that you would have gone through and assessed in your history and physical exam. Were they having any issues with drinking water and coughing when they drink water, or aspiration pneumonia, and that's going to help drive your treatment plan.

Dr. Greg Dion:

But the best way to assess that would be probably imaging with a video fluoroscopic swallow study, so you can assess for penetration aspiration. Though some of that can be done with an in-clinic functional endoscopic evaluation of swallowing. From a more traditional imaging context, chest x-ray might show you a lung tumor, tuberculosis or something in the upper level of the lung. If you have a completely immobile vocal fold, it's really critical that you get some kind of imaging, either computer tomography or magnetic resonance imaging, from the skull base, through the superior [inaudible 00:27:56] to identify any lesions along the course of the recurrent laryngeal nerve. Or even the [inaudible 00:28:02] that may

be causing and impinging on the motion. So it's not uncommon to see a patient, and maybe they come in with unilateral right sided vocal fold paralysis, and then you're working it up and say, "This looks like something we can help you with, it's clearly problematic, let's just get an MRI." And they come back with a glomus tumor. So that is really something we need to be mindful of in the workup.

Dr. Greg Dion:

It is mentioned in the clinical practice guidelines, that imaging shouldn't be done until there's visualization of the larynx, but in the setting of a known immobile vocal fold, you generally should do imaging of the course of recurrent laryngeal nerve. And then, it's a little more of a nuanced discussion when we're talking about hypomobility, how are we defining hypermobile? Was there just a twitch, or is it just a little weak, and that's where your clinical judgment is going to help you decide if you should image or not. And then the other thing people ask about sometimes, far less common, is what about labs? Should we be screening everyone for syphilis?

Dr. Greg Dion:

Syphilis is certainly on the rise in certain parts of our country. These are not tests such as Lyme carditis thyroid function studies, toxin screens, that are routinely recommended from a vocal fold immobility standpoint, unless you have other things that would, would suggest those ideologies.

John Marinelli:

And now transitioning to treatment, maybe we could first start with conservative or medical management for these patients.

Dr. Greg Dion:

Yeah, certainly. So when we think about treatment, I think what really stands out upfront, is really understanding the patient's situation. So is this someone who is a work from home computer programmer who doesn't care that their voice is hoarse and they have no dysphasia. Then you're thinking, okay, well maybe we just can observe this for a while. Or you might be in a situation where the person isn't bothered by their voice, but they've been admitted for aspiration pneumonia to the hospital because they're aspirating. So that's going to help you decide, I should probably intervene.

Dr. Greg Dion:

And really when we know there's a vocal fold immobility, regardless of the ideology, voice therapy by high quality speech language pathologists, really is a key part of this. Because it's going to provide you a number of pieces of information. For example, it's going to allow assessment of compensatory mechanisms, to see how can they compensate without any intervention, will that be adequate, or do we need to think sooner for interventions? And also identify factors such as muscle hyper function, that might actually impair, or need to be worked out to improve overall recovery.

Dr. Greg Dion:

So those are issues that we need to consider. Something to think about, it's accepted that prescribing corticosteroids is not routinely recommended, unless there's something you see in the larynx, some kind of inflammation or something you think that would directly prove that, just because the data doesn't support that at the current time. But once you assess how they're doing, that's going to let you decide your next step. So understanding, going back to that subjective outcome you got in the VHI. The VHI 10 are going to tell us if we need to move forward.

John Marinelli:

Thinking about surgical intervention, maybe we could just go in three broad groups. First being injection laryngoplasty, second being medialization thyroplasty, with or without arytenoid reduction, and then reinnervation procedures. So maybe could we first start with injection laryngoplasty, what patients are you using that in, and a little bit about the procedure itself?

Dr. Greg Dion:

Yeah, absolutely. That's really a good way to think about this whole situation. I would caution, and I think that probably this is a great spot to put in timing. So timing is key. We don't necessarily need to do a longterm permanent procedure on everyone that comes in with a unilateral vocal fold immobility, one week after having a cold or something, and found to have unilateral vocal fold immobility, because we have to give that time to improve. So the general accepted rule of thumb as well, we're going to look at about maybe a year out, plus or minus, lots of rabbit holes to go down there, happy to do it. But even if someone came in, had their thyroid surgery or cervical spine surgery, and the surgeon is like, "I saw the nerve, I didn't cut it. It was intact at the end of the surgery. It's just a unilateral vocal fold immobility, that maybe is from the nerve being stretched. You have to give that time."

Dr. Greg Dion:

That being said, I think your setup is perfect. So if you think about what kind of temporary procedures you have, you could do an injection laryngoplasty. So in this case, there's a number of things that are important here to consider. So one, and I think this is worthy mentioning upfront, is that the data actually support doing this procedure, even if we think the patient will recover. And this is an important consideration, because invariably the patient is going to ask you this question in the clinic, like, "Well, if this is likely to come back because I was intubated for a while, or I had a cold, then why don't I just deal with it, and cough a little bit when I'm drinking my coffee, and it's just going to get better?"

Dr. Greg Dion:

Well actually, it turns out that you won't negatively impact a patient's longterm recovery, or their opportunity to recover by doing an injection medialization, it's going to... Actually, there's some data to suggest that by doing that injection and letting them move forward with therapy and voice therapy, even in the setting that they don't get return of motion, it turns out that there's a decreased need for future procedures in that setting. So there's a lot of powerful reasons in the symptomatic patient who has things impacting their life, that there's a real benefit to doing an injection medialization. So I think that's important to discuss with your patients at the time you see them, because it's a source of concern across the board.

Dr. Greg Dion:

So the other beauty of injection laryngoplasty is that there's a lot of options for this. So depending upon your equipment, comfort, the patient's comfort, your time, et cetera, and access to the OR, you can do this procedure as an in-office procedure, which is generally in my practice what we like to do, or you can take these patients to the OR, which I certainly do in some circumstances. And so in the office, you could do a trans oral, trans-thyroid, trans-cricothyroid, or trans-thyroid cartilage approach. So that's just one of four different approaches you could take to inject the vocal fold with a temporary material.

Dr. Greg Dion:

So in the setting of this procedure, in this situation with unilateral vocal fold paralysis, we're talking about a temporary material, so hyaluronic acid or carboxymethyl cellulose, or collagen, more temporary type injectables, and there are a number of brand names and things you can use, and those differ than the longer-term injectables. So calcium hydroxyapatite is technically temporary, but when you look at that, it's going to last 12 to 18 months in that area, which is probably more than you're looking for, for a temporary situation. So that's considered a more long-term.

Dr. Greg Dion:

And then from a historical standpoint, Teflon was used a long time ago because it is permanent. Has a whole host of issues, largest being terrible granuloma formation down the road, which is problematic to deal with to get that out. So you're obviously going to go with temporary injection, and then autologous fat, there's lots of discussion about how long it lasts, but in many cases, it's really going to be considered more permanent again, so not used in that short-term scenario.

Dr. Greg Dion:

Those injectables can be done in the operating room or in the clinic, again, based on your comfort and your patient's comfort, your situation, your setup, your equipment. The great part about that is you can get patients near immediate relief and improvement, particularly when we're talking about patients becoming short of breath because they're losing all their air and they have so much air escape or dysphasia, that's very, very, very fast improvement. And then even with their voice, you can get near immediate improvement, though that is almost always augmented by quality voice therapy.

Dr. Greg Dion:

There's this conceptual risk when I work with residents that am I going to over inject? Theoretically, I suppose yeah, it's probably possible, but when you really watch this, particularly in the clinic, you'll see that you're watching it happen, and I would say the majority of cases that people felt like their injection wasn't great was that they under injected and probably didn't give as much closures as they wanted.

Dr. Greg Dion:

And so what you want to do is you want to keep that deep in the muscle and want to make sure you're not injecting the superficial lamina propria, because in that case, you're going to impair vocal fold vibration, and so now you have a patient that has a tight voice that doesn't have vibratory function, and so it's one of those things that you want to avoid. Thankfully, with a temporary material, that's going to generally go away and how to deal with complications in in-office procedures is a whole nother discussion.

Dr. Greg Dion:

But the reality is, this is a great procedure, short, even if you do in the OR, get the patient relief and then it allows you to then watch them over time and decide what's happening. Now, if they think they had a nitrogenic injury and the nerve was just stretched during a neck procedure, you can watch and see what happens, but you're going to follow that patient closer to a year before you kind of dive into something more permanent.

John Marinelli:

And maybe next, could we talk a little bit about medialization thyroplasty or a type 1 thyroplasty?

Dr. Greg Dion:

Yeah, absolutely. So now we're way down the pathway of we think that this patient's not going to make a recovery and we've watched it for a while. Say we thought the nerve was stretched after a thyroid surgery and not cut, and so we've waited a year +- EMG, probably not really going to improve, and the patients are having trouble with quality of life again, either swallow or voice issues, and so as a result, we need to do something to medialize the vocal folds. So in broad strokes, we're going to say let's approach this with a medialization laryngoplasty/thyropasty, where we're talking about medializing the vocal fold inward with some form of implant in such a way that we're properly positioning the vocal fold. So there are a number of ways to approach this. We can kind of break this down largely into the context of silastic block or Gore-Tex strips, which both are used as safe, longterm materials to medialize that vocal fold.

Dr. Greg Dion:

In the setting of this, you're going to keep the patient awake in the operating room so you can talk to them and hear their voice improved during the surgery, and you're going to visualize the larynx with a scope. And so there's a number of "artistic ways" to set this up. Some people hang the scope from a pole. Other people, you can simply put a scope laying on a stack of towels on a Mayo stand into the patient's nose as you're watching it, watching your procedure. Some people have an extra provider who could do a scope at the time of the medialization.

Dr. Greg Dion:

What you're going to do is you're going to numb the patient up, making an incision, dissect down onto the thyroid cartilage itself, make a small window. The window size is going to vary depending upon if you're doing the silastic block or a Gore-Tex strip. And then try to keep that really inferior, which is generally, in my experience, one of the ways that I see young surgeons or learners making errors and a little bit high, but you're going to see as you make that window and dissect in there that when you look on the screen at the larynx and you're using an instrument to probe, you're going to see that you're either too high, too low, or just the right spot.

Dr. Greg Dion:

So inferior posteriorly, you're going to start putting in your implant to see that immediate feedback of the patient's voice. And obviously, the more of these you do and the better you get in terms of being somewhat efficient with your time to avoid the effects of edema. You're really going to be able to set up a nice voice for that patient, after which you can close up the neck, put a bandage there, send them home, and then they're going to do great.

Dr. Greg Dion:

Now things to consider is, there are situations where perhaps that nerve injury has caused the arytenoid to become a little bit unstable because it's not held in position or latched in position by these muscles because they're all denervated, where that arytenoid slides off and gets pushed over by the functional vocal fold. Or really sometimes during surgery, you're just not happy with your voice that you can get with a simple medialization, be it either a cut strip of cortex folded into position or a stylistic block. And in that situation you can do an arytenoid adduction.

Dr. Greg Dion:

So for that, in very broad strokes, you're going to take a needle and lasso or get the edge of the arytenoid and then pull it forward. So you're causing medial rotation of the arytenoid and proper placement of the vocal fold for phonation. And then you do your medialization after that. Personally, I think you get a really huge outcome and correctly chosen and performed arytenoid adduction. With that in mind, it's certainly a more technically challenging procedure than a medialization thyroplasty.

Dr. Greg Dion:

With that said, just like everything in medicine, we're making lots of new advancements. And so there are some opportunities where there's some protocols that are being worked out now where you can put the patient to sleep to do your arytenoid portion, because it's a little more uncomfortable for the patient, or for you depending upon your experience and comfort level. But then you can wake them up still on the table and then have them talk while you do your medialization portion.

Dr. Greg Dion:

So I think that, albeit, a challenging procedure or at least a little more technically complicated, I think it's a phenomenal procedure, correctly chosen patient to really give them a home run voice.

John Marinelli:

And lastly, what about reinnervation procedures?

Dr. Greg Dion:

Yeah, I think the frontier for reinnervation procedures is here. And I think that in the correct setting, these are very valuable procedures. So a few things to consider here is this seems to be the most effective in the younger population. So probably not someone who's 75. With that in mind, plenty of people have certainly had success in that scenario. So the aim here is despite some of this intense and new research being done in various facilities where we're trying to get muscle tone bulk and provide the same kind of response you're going to get from an injection or a medialization thyroplasty.

Dr. Greg Dion:

So in this case, what you're most typically going to do is just a nerve to nerve reconnection. So you're going to take another nerve in the local region, and that might be the ansa cervicalis is a great option. So you take the ansa and loop it back to the recurrent laryngeal nerve, just as it enters to the larynx. And so you sew it together there. And so you might use traditional suturing the nerve back together. You might use one of the newer neuro couplers. And all of these are going to allow you to end up getting essentially synkinesis. You're not going to have vocal fold motion, but overall that synkinesis in bulk is going to allow you to produce adequate phonation, much the same way that you end up with a good voice after medialization thyroplasty.

Dr. Greg Dion:

Now this is going to take a few months, at best or shortest, to work. So you're going to do probably a concomitant and temporary vocal fold augmentation at the same time. Some centers advocate doing arytenoid adduction to position things and fix it in place to then optimize bulk. It depends on your experience and what you read. There are other things and other types of this that people do. Obviously if you were in the OR when this happens, you do it immediate end to end stenosis and recurrent laryngeal nerve. But that's really not the setting of which we're talking. We're seeing these patients months later in follow up and doing these procedures far out.

Dr. Greg Dion:

Probably ansa lately the best. You could try, like I said, more specific targeted anastomosis. So anastomose the ansa to just the adductor branches of the recurrent laryngeal nerve. So you've figured out where the PCA comes off, not reinnervated that branch and reinnervate the rest. There are other forms of reinnervation that have been explored over the years. So briefly that would be our neuromuscular pedicle grafts. In that case, you're implanting a piece of muscle. You need to make sure, at that case, that you are not having other identical innervation from two different sources because that renders it ineffective. And then from a larger standpoint, probably discussed in the setting of bilateral vocal fold paralysis, you have selective renovation with the phrenic nerve to coincide with breathing. But that's generally not done for just a single unilateral vocal fold.

Dr. Greg Dion:

Really it's worthwhile saying, well, "What's the best thing for the patient?" That really is up to the patient. When you look at the outcomes of what are they looking for? What is their goals from getting this? What is their job? What are their voice needs? How bad is their swallowing? What's their health status? What could they tolerate? So interestingly enough, patients who are considered generally not great anesthesia candidates can do really well with a medialization laryngoplasty because they don't go to sleep when you do a thyroplasty with silastic blocker Gore-Tex.

Dr. Greg Dion:

So in the setting of small gaps, autologous fat transfer might be a longterm solution for somebody who the nerve is not moving because they have a lung tumor and we're not sure how that's going to be worked out for the next few years. You can do a longer term injection with calcium hydroxyapatite and revisit the situation in 12 to 18 months when that wears out, just to see how they do. So there is certainly not a recipe for success here. I think this is a great opportunity for a thoughtful resident or a thoughtful otolaryngologists to really look in their tool set and say, "What are my outcomes with these various procedures? How can I apply them in each individual patient setting to really find and optimize my outcomes?"

John Marinelli:

And when we think about expectations, prognosis, followup, that sort of thing, any comments you have about those ideas?

Dr. Greg Dion:

Yeah. I think that you certainly, in the patient, if you're doing a temporary procedure or early on that has a unilateral vocal fold immobility, A, you need to get to the bottom of why. So if it was a cervical spine surgery and they suddenly have immobile vocal fold, you have a sense of why. But if we need to work out the imaging, we certainly need to see them back to make sure there's no tumor we've missed, even in the setting of them being compensated and not having a lot of voice issues. In the patient for which you do initial procedure you need to set up a followup. So say you use carboxy methylcellulose, you're going to want to set them up to follow you back in a couple of months, just to see how they're doing, how their outcomes are.

Dr. Greg Dion:

And then you want to follow the situation to its logical conclusion. So either that's vocal fold return to motion or in the setting of vocal fold paralysis that you've worked out and you've done your due



diligence and realize that it's been a while and it's not going to come back, generally, like we said, say thyroid surgery where they thought it was just stretched, but it hasn't returned close to a year, then you're going to say, I'm going to do my penultimate procedure, thermoplasty, arytenoid reduction, reinnervation, et cetera, and then ensure that they have adequate outcome before sending them off.

Dr. Greg Dion:

But I think it's important to ensure along the way the patients are getting the care they need, and that's going to include high quality voice therapy with a good speech language pathologist and then adequate followup to make sure that you're checking in with the patient.

John Marinelli:

Well, Dr. Dion, I think that pretty much covers all the questions I had for you. Was there anything that we didn't talk about that you think is worthwhile to mention?

Dr. Greg Dion:

Yeah, I think the one thing I mentioned is that there's always more that can be discussed or said about what's the chance of recovery and that's what every patient wants to know, and the hard part about this is we don't always know why and each of those situations presents their own unique issues. In the patient that the surgeon is sure that the nerve was not transected during surgery but there's no motion, I think time's going to help us tell. And so as time progresses, we can tell that patient, "Hey, we'll know that your chance of recovery each time we see you is going to be less, right? If your nerve is not working two weeks after your neck surgery, you have the best chance of recovery versus if you come to see me six months later and it's still not working, your chances of recovery are far less."

Dr. Greg Dion:

And so that's kind of been worked out in some interesting, well-written papers, finding that those percentages quickly drop off. If you're going to recovery, your likelihood of recovery is generally in that first three to six months. And then your chances of recovery after that are very, very small, though with that in mind, we still do because of the healing process of nerves wait towards a year.

Dr. Greg Dion:

I think that that's a frustrating part for patients and residents and laryngologists to consider because we all want to give the patient an answer, but sometimes the medicine, we just got to let it take some time and see what we can do. And again, as far as EMG, that really depends on your setting, your scenario, your comfort level. And in many cases, it maybe isn't going to change your clinical practice in terms of what you're going to do. Overall, I just hope this was a chance to give some kind of insight into the thought process of approaching this and get people thinking about it.

John Marinelli:

Well, Dr. Dion, we really appreciate your time, so thanks for coming on.

Dr. Greg Dion:

Anytime. Glad to be here.

John Marinelli:

In summary of today's episode, patients with unilateral vocal fold immobility can present in a wide variety of ways affecting many ages, and they may be entirely asymptomatic, but oftentimes patients will complain of some hoarseness, some breathy dysphonia, perhaps even maybe some dysphasia or aspiration depending on the underlying cause and potentially even stridor in children.

John Marinelli:

Workup includes a comprehensive history and head and neck exam with laryngoscopy and video stroboscopy. As recommended by the most recent CPG on dysphonia, any dysphonia that does not improve in four weeks time or if there's a concern for a serious underlying cause, it's very important that patients undergo a laryngoscopy.

John Marinelli:

Other diagnostic considerations include videofluoroscopic swallow study, as well as imaging of the head and neck to identify potential underlying etiology, such as malignancy and to risk stratify for the potential underlying aspiration.

John Marinelli:

There are many different routes of treatment, everything from conservative medical management to surgical intervention. Surgical intervention typically falls within three overarching categories, including injection laryngoplasty, medialization, thyroplasty or type one thyroplasty with or without retinol deduction and then reinnervation procedures.

John Marinelli:

Long-term, patient engagement in voice therapy is really key to their success. And oftentimes, these patients end up being very happy with their voice quality long-term.

John Marinelli:

All right, now I'll move on to the question portion where I'll just ask a question, pause for a couple seconds, wait for you to think about the response and then give the answer. First question for today is what is the most common cause of unilateral true vocal fold paralysis and what is the most common malignant cause? The most common overarching cause is surgical iatrogenic injury. Most common malignant cause is actually lung carcinoma.

John Marinelli:

Second question. What is the name of the motor nucleus of the vagus nerve and what are the findings in Wallenberg or lateral modularity syndrome? We briefly touched on this in the differential diagnosis. Tough question, but the nucleus of the vagus nerve is called the nucleus ambiguus. It's located in the medulla, and then lateral megillah syndrome occurs secondary and infarct of the poster inferior cerebellar artery and classically results in vocal fold paralysis, dysphasia, loss of pain and temperature on the ipsilateral face and then contralateral body, and maybe even ipsilateral Horner syndrome.

John Marinelli:

Third question. Related to physical exam, define the maximum phonation time and findings on videostroboscopy. The maximum phonation time is defined by the length with which a patient after inhaling as deeply as possible can sustain a vowel. Normative values are 15 to 25 seconds for women

and 25 to 35 for men. And then on videostroboscopy, just recall that we always want to evaluate five primary things, first being vocal fold symmetry, next being closure, third being amplitude, fourth being the periodicity, which if you can't see the vocal folds moving, it means the motion isn't periodic, and then the mucosal wave. In unilateral vocal fold paralysis, you'll classically see an increased amplitude on the paralyzed side.

John Marinelli:

And last question, what nerve has similar structural composition to the recurrent laryngeal nerve and therefore serves as a good option during reinnervation procedures? Correct answer here is the [inaudible 00:52:47].

John Marinelli:

Alrighty. Well, that'll wrap things up for today. Thanks so much for listening and we'll catch you next time.