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Dr. Kendal Williams (Host): Welcome, everyone, to the Penn Primary Care Podcast. I'm your host, Dr. Kendal Williams. So, a few weeks ago, we had the opportunity to address the issue of back pain, which is so common in primary care and in general care everywhere. More than 70% of people are going to have back pain in their lifetime. So, it's one of the most common things that doctors manage.

In that episode, we were joined by two surgeons to talk about back pain and some of the approaches that they take. But most commonly, we manage these non-surgically. And so, I asked two experts at Penn to join me and talk about the non-surgical management of back pain. So with me today is Dr. Adrian Popescu. Dr. Popescu is an Associate Professor of Physical Medicine and Rehabilitation at Penn. He is the Director of the Spine Service within PM&R and also the Director of the Interventional Spine and MSK Fellowship at Penn. Adrian, thanks for coming.

Dr. Adrian Popescu: Thank you for having us.

Host: Also with us is Dr. Douglas Gugger. Dr. Gugger comes from the other side of the non sort of surgical management. He comes from the Anesthesiology side. He is an Assistant Professor of Anesthesiology and Critical Care at Penn, and he is the Program Director for the Pain Med Fellowship within Anesthesiology. Doug, thanks for coming.

Dr. Douglas Gugger: Thanks for having us. I am the Associate Program Director. I work with Sharmil Gohil.

Host: Sounds great. So, at Penn, you know, when I evaluate a patient in the primary care environment, I do my own evaluation. I decide if there are any red flags present that need to be evaluated more urgently with imaging. If not, sometimes I'll send them to physical therapy. Oftentimes patients have come in, and they've done some physical therapy on their own or have seen chiropractors or sort of gone down a little bit of the path of back pain management already and they're looking for something more. And it's at that point that I refer them to you. And then, patients go to the Spine Center where they're evaluated by sometimes the very doctors that are on this podcast today. So, what happens when we send them to you? Adrian, maybe I'll start with you.

Dr. Adrian Popescu: Sure. We welcome them and we tell them how good of a partnership we have with primary care. And we get a sense of why they are there, what bothers them, what's the chief complaint. And we try to get the patient to understand that it's more of a consultation, more of an opinion, rather than curing the patient at the first visit. And this is the beauty of Penn where we partner with many specialties. We always have an official or unofficial consult to call on getting an opinion about something more complex, or if we have a need for other specialists.

So, we evaluate their gait. We evaluate their limitations, the functional limitations. We understand if the chief complaint is, one, lower back pain, or the chief complaint is many where they have neck pain, they have shoulder pain, they have wrist pain, knee pain. And we try to focus on one thing at a time if we can. And I think connecting with a patient is the most important part that we do at the first visit and understanding their angle, understanding their functional limitations and understanding their goals. If their goal is to be able to walk with the grandkids in the park, I think that's a great goal. If their goal is to run a marathon like they did 50 years ago, might not be a realistic goal. So, I think understanding, connecting, listening is my goal in the first visit.

Host: Doug, how do you approach this?

Dr. Douglas Gugger: Yeah, I think that Adrian brings up a lot of really, really good points. And I have to say that my approach in many ways is very similar in the sense that the referral that we get from you guys is oftentimes a lot different in the way I would necessarily approach it than I would from like a spine surgeon. A spine surgeon, it's typically a very technical consult where they're asking for a very specific block to figure out a very specific problem so that they can help either planning a surgery or maybe postponing a surgery for a period of time, versus the consult or referral we get from a primary care practitioner or even from a rheumatologist, which is every one of those referral bases are vastly different.

I think in primary care, to Adrian's point, is it's I'd say probably more of a holistic approach that we're taking because we do, out of necessity, have to assess them from the ground up and figure out what, where they're at in life, is it like a 30-year-old mother or a mother of two young kids? Or is it someone who's, like Adrian mentioned, like 70 and just wants to be able to play with their grandkids. So, it's about understanding their motivations, where they're coming from, what they need from what we can provide, and then figuring out their goals, and then also figuring out their baseline functional level, where are they at then, and where would they like to go. And then, you can kind of

address things as is, in that kind of context with them, and decide, is it like as Adrian pointed out, is it a realistic goal that you have? You're 75 and have horrific spinal stenosis and don't want surgery, your goal of running a marathon, unfortunately, if I have to tell you that, I'm going to, but it's not a realistic goal. We should talk about like, "Okay, let's start with getting you around the block before we get you running," and trying to partner with them and allow them to essentially set the goals themselves, but understand it's within a context, and there are certain things we're going to be able to do to help improve their functional status. But instead of just caging it as we're going to help you improve your pain, we're going to help you with the pain, but it's really as a means to improve your function and to meet some of those goals that you're going to lay out in the first visit. But I think when we get a referral from you guys, the difference is that they'll get more of a holistic approach, because we have to take it from that angle when we get referrals from primary care.

Host: So, when I refer someone to you, and I'm just going to kind of go from my own experience, oftentimes if somebody comes in and I really feel it's ligamentous or muscular, they've thrown out their back, they tried to lift something that's too heavy, it's been a few days, they're not having any neurologic signs, they're not weak, nothing going down their legs. Those folks I probably will just manage myself, send to physical therapy and so forth. The ones that I would send to you are the sciatica patients who are not improving, so they have lumbar radiculopathy and they're not getting better with initial therapy, or I think it's severe enough that I think it might need more intensive intervention early. Yeah, so let's talk about how you sort through that group. Let's talk about the disc herniation patients, I guess, specifically. What can you offer that I don't offer?

Dr. Douglas Gugger: That's a good point. There may not be anything necessarily. It depends on the situation. I am always impressed by the care that you guys do in general from an internal medicine standpoint with the ones that I see. I used to practice in private practice, so I've seen a large swath of territory in that regard, and the same goes for my specialty as well. There's a large spectrum of skill level, but I am thoroughly impressed on average as to what you guys have already accomplished by the time they come across my desk. But I think you bring up two very important points in different patient groups there. There may be the person that you suspect has a disc herniation and does have a disc herniation, and you've exhausted the physical therapy or the medications that you would typically recommend to start with. Those individuals either have plateaued or they're worsening and not improving. I think giving them a trial of an injection is worthwhile, or the other group that you brought up, and I think that we could always do better in this sense, getting people in sooner to get them in. And I think ultimately my belief is that physical therapy and time are the key

drivers, and people improvement and they're improving over a course of a year or two years, and I think that's been shown. But where injection therapy helps is if the patients aren't improving, that goes back to your first case, or if they're in such severe pain that they won't be able to tolerate physical therapy. And an injection may help in both of those cases to kind of push them in one way or another. It'll allow them to dictate or determine whether is that someone that's not going to get better and requires a discectomy, or is that someone who we can get them better, we just have to give them the time to get better, improve on their own and with therapy?

Host: How do you do injections for disc herniation itself? So for sciatica, the typical patient, it's L4-L5 or L5-S1. I think that's 90% of the involved vertebrae. And then, they have radiation down their legs. So, you're fairly confident you have sciatica. It's pain, it's not weakness. Otherwise, if it were weakness, we'd probably be sending them to the surgeons earlier. But, Doug, you mentioned injection. What do you do? Where do you inject? What do you inject?

Dr. Douglas Gugger: So, those are good questions. I think just one other addition there is if I'm going to do an injection, definitely, if I'm going to consider it and you would like us to consider it and you guys always do, but I would make the point that that individual should have an MRI before I'm putting a needle anywhere, because God forbid they have discitis or something like that that we're missing. We want to make sure of that. And you're right, you could get 90% of the way to determining where I'm going to put a needle based upon their exam and their myotomal or dermatomal distribution pattern as to where the disc herniation is, but not always though. So, it could be you have a far lateral L4-L5 disc herniation, looks like an L5-S1, and it would help.

Anyway, so we get them in and say we're going to bring them in for a procedure. We'll go to one of our surgical centers. Adrian is typically at Tuttleman, I'm usually at Radnor. But, you know, it's under live fluoroscopic guidance, which is our standard of care at this point in time and has been for some time. We bring them in, and it's a completely sterile procedure. So, we do everything sterilely, just like you would if you went to surgery, with the exception we don't get gowned, but we wear sterile gloves. And it's under Chloraprep with sterile drapes.

And then, the next step is we bring in the x-ray, and we utilize the x-ray to locate the specific level that we've already comparing back to the MRI. So, let's say it's an L4 disc herniation, the L4-L5 disc herniation, and it's leftward. So, evidence would support that you should do either a transforaminal epidural

steroid injection, meaning coming in from the angle of the foramen, and you would probably either do it at L4 and L5, or maybe just L4, depending on where their significant amount of symptoms are, or the other technique that we will sometimes use is what we call an interlaminar epidural steroid injection, which I think like if you've ever seen an epidural done in the past, it's with a loss-of-resistance syringe and similar to what you would do for any sort of like when our wives would have had children back whenever that may have been. But the transforaminal approach is, technically speaking, a more targeted approach in which you're kind of, I always say, like bookending the disc herniation and kind of getting steroids right around where that disc is herniated. The idea is that you're getting the steroids to the area where that herniation is causing that nasty inflammatory reaction, especially in the acute phase. This is what we want to do, and it will reduce any sort of significant inflammatory processes occurring at that time to then reduce the pain.

And I know you mentioned the weakness typically going to a surgeon. You can see improvement with weakness if that area, the inflammation is decreased enough after an injection to improve it. But I totally agree, if there's weakness involved, I also would probably send to a surgeon to be safe.

Dr. Adrian Popescu: Or just for an opinion. To go back on the disc herniation, you know, the first thing that we do, I'm trying to understand if the patient has a preferential direction, a preferential position, something that takes the pain away. And that's a very, very good outcome indicator. And without going into details, the epidural injection or the selective nerve root block, if the referral comes from a surgeon, how do we do those precise? It's all about precision. It's all about covering the target area with the medication. Anything else in our practice is suboptimal.

And I really like that Penn Medicine is very unique in having something that a few hospital systems have. I mean, that's called accountability to your peers and to the patient. So if you send me a patient, I better do the best I can to get that patient back on his feet. Because then, you're going to call me and say, "Adrian, you were talking about precision and nothing got accomplished." So, in one word, how do we do procedures? Precision. And I think it's key to understand that covering the correct target with contrast dye and using the proper medication, using the common safety measures that we use, the digital subtraction imaging, and everything else as a standard, I think it puts patients at ease and it puts our colleagues at ease.

Host: What are your expectations following a steroid injection for a disc herniation? Is it curative?

Dr. Adrian Popescu: It depends. So depends on location, size, patient's subsequent care. So, it's well published in the literature that if the patient does five times a day, five minutes or 10 minutes exercise, McKenzie or mechanical diagnosis and treatment-based exercises in addition to a very well-performed injection, the outcomes are better than doing either the injection or the therapy. So combining those two, I think, gives you better outcomes.

I think the phase of the inflammation or acuteness, we all like acute pain. Because acute pain, we can treat, we can get the patient out of the pain, we can treat that inflammatory response around the nerve and the outcomes are better. And we need to look at the literature. I'm looking at literature that actually Penn Spine Center was part of. I'm looking at adverse events, very, very low. No catastrophic events. I'm talking about outcomes. What should I tell the patient? I should tell the patient that, you know, at least 50% of the patients or probably at least 50% better at two months. And one in four of those patients can be better at one year after one injection, okay? Never a series of three, and some people benefit from the additional and again, it's all based on anatomy.

So, going back to what Dr. Gugger said, we look at the pictures. It's a technical part. We're the mechanic that needs to understand the pictures and the technique and how do we get there. And the surprise is we did have all the time, right? Where you have an outside hospital imaging read that looks almost normal, mild, mild, mild. And you look at the real images and say, "Ha, this is a foraminal disc that is clearly there," and we find the source and the patient is happy after we treat.

Host: So, I wanted to ask about MRI and going back to to Doug's point that you want good imaging so you can be very specific in your location and so forth. I have gotten away from ordering MRIs myself within our system. And the reason is because we do get some pushback from insurance companies for ordering MRIs for back pain, because it's an overordered procedure and oftentimes does not result in downstream treatments. But you're saying that you do need it when you're thinking about injections, A, and, B, you know, you can really help people. So, I guess I now would frame it as it is a pre-procedural test more so than anything else.

Dr. Douglas Gugger: Yeah, absolutely. I would agree a whole heart. I mean, I think you're also talking about potentially different patient populations that you're referring. If you're suspecting it's acute disc herniation, then I do think that it's certainly something that I would recommend sooner rather than later. Because then if there is a need for whether it's an epidural or, God forbid, they need surgery, and there is some evidence to suggest that if people have

refractory pain despite conservative therapy, there is benefit to having an early discectomy. So, I think if you put it within that framework, then it makes sense for that group of people to have an MRI early. If you're talking about someone who's, you know, 65 and has chronic low back pain, then no, absolutely not. I totally agree with you, and it's not necessary to have an MRI from the outset if they have not done some of the more conservative therapies first. Or if you have a strong suspicion that this is not an acute disc herniation, it's more of like a chronic musculoskeletal flareup of someone that you've been seeing for years, but it just happens to be an acute flareup, then, no, especially if there are none of those red flag symptoms, I don't think an MRI is warranted. But I think the groups that you're talking about are a little bit, you know, then, it depends on that particular clinical scenario, I think.

Host: Adrian, I wanted to go back to the sciatica patient who comes to see you. Are you giving them some time in rehab before considering injection or based on the discussion you had before about patients do best when it's both they have an injection and they do physical therapy, they do the best. Are you thinking even earlier to do it? How are you making that decision for the sciatica patient?

Dr. Adrian Popescu: So, I ask my favorite question to understand what they do for a living, where they are in their lives, and if they may lose income for their family, if they may lose time with their family, if they may not be able to sleep at night, I will do everything that I can to optimize and just improve the outcome the best I can, including, but not limited to imaging, injection care assessment for preferential direction for physical therapy. And a lot of times, I just ask them, is it better with therapy? What do you do in therapy that makes it better? And if nothing makes it better, I might make a phone call to my colleagues in surgery and say, "Listen, this is a large disc. The person has only two weeks of sick time. And the person is the breadwinner." So, we all need to relate to that. This is our patients. And a lot of times we put ourselves in their shoes or our family member in their shoes. And I can send you to physical therapy forever, but if you lose your job, most likely you're not going to like me. So, it depends on the situation. We tend to be extraordinarily conservative. And I think we even had interesting audit in terms of the number of injections for new patients. And that is like 1.3 injections per year for new patients, which tells you that we are very conservative. But at the same time, we're very aggressive to treat what can be treated using evidence and nothing can stop us from being aggressive in treating a patient and getting the patient back to their lives.

Host: So, the other scenario, and Doug, you referenced this earlier, is the sort of the more arthritic back, right? These are usually older people, although, of

course, a disc can herniate at any age. But generally, the arthritic back are over 50, I'd say, generally. So, these are folks that have disc degeneration over time, and they have facet joint disease and so forth. And so, what's the role of injection in that population?

Dr. Douglas Gugger: So that, in my mind, is definitely a harder group of patients to kind of qualify, quantify, and, then treat appropriately. And it does get back to what Adrian said, the key to all of these individuals is being precise with, one, your diagnosis, like your physical diagnosis in the office and hearing their stories and what bothers them, what elicits their pain. And on exam, I think they're more of the puzzle.

Listen, most of all of us in this room space here can diagnose a disc herniation with sciatica. But where I think more difficult patients come is where you have someone who's got chronic pain, maybe some kind of waxing and waning radicular components, you're not really sure. But those are the individuals you really have to sit with, figure out when the pain is at its worst, what's eliciting it. And then, if you are going to suggest a procedure, that's where it's really key that you're as precise as humanly possible. But to the same degree, a lot of times we're using those are procedures in that group of people, as much as an extension of the physical exam to help us figure out what's kind of driving their pain. Like you mentioned, is it facet-mediated? And you know, is that something where we're going to go down what we call the lumbar medial branch block to radiofrequency ablation? Or is it something in our field, I think, like referring to discogenic pain, I don't know if taboo is the word that comes to mind, but it's something like, "Well, for a while, discogenic pain didn't exist. And then now, we do recognize that with the degenerative process. There are some increase in nerve fibers in the end plates, that it is a real entity." But then, the challenge becomes, "Well, then how do we treat that?" And we are kind of getting there, and Adrian's one of the individuals bringing some of that technology to Penn. But to your original point, we oftentimes will use the different procedures that we may employ as much as an extension of our physical exam to help diagnose the problem and then treat it after, once we kind of help figure things out a little bit.

Host: So usually, based on an MRI in, say, sciatica where you have a disc herniation, you can really identify, you see exactly where the problem is.

Dr. Douglas Gugger: For the most part, yeah.

Host: Yeah. In the more chronically arthritic back where patients have a flare, you don't know if it's the facet joint, it's the disc, you don't know. And so, you're

really trying to figure out based on physical exam what to target and then you might inject a particular facet, for instance, and make an impression.

Dr. Douglas Gugger: It's true. And the thing is there are studies after studies, especially in this group of people, that have shown, even with all of those various aspects, including an MRI with facet arthropathy, that there's still not a direct correlation between what you think, which is axial back pain, facet arthropathy, and what their experience would be and their success would be with medial branch blocks and an ablation. So, it's still not a linear pathway that they have. And that's still to some degree, a little bit of a holy grail in our field, I think.

I'm trying to further elucidate those kinds of pathways and who best would be suited for some more of a facet-mediated kind of procedural basis or something like. I'm hoping Adrian will talk more about the stuff for the discogenic back pain as well, because I think it's exciting too. But, I mean, they should have certain clinical elements that should clue you in, but not always. And it can be a bit of a challenge. And we've even tried to use like things like FDG-weighted, like SPECT imaging and things like that. And there was some evidence that stuff was a little bit better at predicting the specific facet joints that were aggravated, but still not perfect. We do use the procedures in that group of patients, as much as a diagnostic tool, as it is a therapeutic tool.

Host: Adrian, I guess for the arthritic back, you have different expectations in terms of outcomes, because this is a more chronic process. And so, as opposed to a disc herniation, which may be an acute thing you can fix quickly, the chronically arthritic back is something that you have to manage expectations a little bit more, right?

Dr. Adrian Popescu: That's what we do. We manage expectations and we play a detective. And we try to be a good detective. And I understand the pain generator and the structure or the structures that generate the pain. And some of them are posterior elements, like zygapophyseal joints, or so called facets, and some of the structure can be a pedicle fracture, secondary to disease, or some of them can be bone marrow changes that can be secondary to a systemic disease like multiple myeloma that sometimes cannot be diagnosed just with an MRI, a simple MRI. Sometimes it can be vertebrogenic pain, discogenic pain. We're learning about inflammatory changes and some school of thought think that this is a new biomarker for vertebrogenic pain. Even with certain ablation procedures or basivertebral nerve ablation procedure, we don't get 100%. If we have a good diagnosis and we look ourselves in the mirror at the end of the day,

we're doing solidly, technically sound procedures, we obtain the best possible outcomes for the patients.

But again, we need to play detective. And we need to have the ears wide open to listen to the patient, not just hear the patient and try to understand better the pain generator. And of course, that spinal stenosis can be severe and the patient would tell us, "Oh, I have no leg pain, I have no leg pain, doc." But the only structure that is different is the severe spinal stenosis. And some patients just manifest themselves with severe spinal stenosis with back pain. And they don't have leg pain. And if they don't have leg pain, some insurance companies, they just flat out refuse their surgery. And we don't want to go into group, but we have to acknowledge the fact that the care of our patients lots of times is dictated by some insurance companies that do not understand, the literature do not understand, the patients do not understand the need for the patient to be recovered and have a job and support their families. But that's probably for another time, because we want to keep it nice tonight.

Host: Well, I think for all of us, and including insurance companies, we just want to better understand what it is each of these modalities offer. I think that it's probably true that this area has advanced so much that even insurance companies haven't quite caught up with a lot of the things that are available.

Adrian, I want to go back, and Doug, I want to go back to the specific procedures. Because we talked about steroid injections, which are valuable to reduce inflammation. And then there are circumstances in which you will give, you know, lidocaine or a numbing medication to try and do a diagnostic to figure out if that's the area that's most painful. You've mentioned nerve ablations, which sounds a lot more permanent than just a lidocaine injection. So, I would assume you figure out which nerve it is that's causing the trouble, and then if you can ablate that, you do that. Is that right?

Dr. Douglas Gugger: That's correct. Yeah, so let's just say it's a very standard run-of-the-mill person with axial back pain, like we mentioned someone in their 50s, 60s, 70s, 80s that may have what you assume is fairly pronounced facet joint disease that's their primary pain generator that correlates with MRI findings that do suggest that there's at least some facet arthropathy, maybe even some joint changes, effusions plus or minus on the effusions. And then to some degree, you've also used the MRI as well as your exam to ensure that you're going to be targeting the proper joints. Because getting back to the insurance standpoint and actually for quality patient care, you don't want to be treating, let's say, all the lumbar facet joints. We treat typically two facet joints bilaterally, usually bilaterally, not always. If pain is just left-sided, then we'll

just treat the left-sided facet joints. And most commonly, let's say for instance, it's S1, which is the most common joints that we are treating in the lumbar spine.

So, the way that, many years past, we would do like a facet joint injection, similarly to if you were to have a chronic knee problems, you would do a knee injection, intra-articular injection. The facet joint is a synovial joint. It's encapsulated. So, you can inject it with steroids the same way you would those joints. We've got away from that because we found that it wasn't quite as effective as using an ablation. There are some small subgroups that it may still work, for instance, like younger people that maybe have a traumatic facet arthropathy or something for various reasons. But for these individuals, the medial branch nerves supply the sensation or innervate the facet joint. So, what we do is we go in using fluoroscopic guidance. And similarly to a dentist, which the dentist will do applyingly, but we target the intersection between the superior articular process and the transverse process, which is kind of where the medial branch nerves that supply those joints lives. And we inject lidocaine. I mean, you could do it a number of ways, but I inject 2% lidocaine, so I ensure at like half a cc to ensure that I'm getting as diagnostic a block as possible. We block both sides. Three nerves typically would be enough to supply the sensation or innervation to those joints. The patient goes home with a diary, a pain diary.

This is where it's important that, as Adrian pointed out, that they're very well, we've done a good job explaining to them what the expectations are because we want to make sure that they know that the duration of action with lidocaine is three to four hours maximum, that that's all they're going to expect for pain relief. And then, they go home, and we ask them to do things that would normally cause them pain. We ask them their pain scores, but also we want to know about functional improvements during that period of time. And then if they do well, we have them come back for a second set of diagnostic injections. Assuming that they do well with that, we look for 80% relief from their axial back pain or typical axial back pain. And then, we are able to go in.

The final step is we'll do what's called a radiofrequency ablation, where we use high-frequency radio waves, ablate that nerve at that junction up to about 80 degrees Celsius for about two minutes, everyone's a little bit different, but between one minute and 30 seconds and two minutes and 30 seconds, I think, is pretty much the standard. And the nerve, over the period of the next one to four-ish weeks, you're ablating that nerve, killing that nerve, and their pain during that period of time is expected to improve gradually. And what I usually quote is expect if it's a well-placed block, and I'm really happy with the ablation, six

months to two years worth of relief. And the reason for the fact that the pain comes back is those nerves regenerate so you will get some sensation back in the joint at some point, usually.

Host: But you really go through a process of identifying and making sure that they are better before you ablate the nerve. You've gone through that process you described.

Dr. Douglas Gugger: You would not proceed with the ablation had they not improved with those first two steps.

Host: So, we've been focusing on the facet joints. And Adrian, I want to go back to discogenic back pain, which is the disc itself we think maybe painful. I understand this whole area is controversial. We don't know how much it's innervated and so forth. But let's say you don't think it's the facets. And Doug had alluded to the fact that you have some expertise in this area. How would you approach somebody that you thought where the disc itself was causing the pain?

Dr. Adrian Popescu: Sure. So, yes, just to build up on what Doug discussed about the posterior column and consider that those treatments were developed in the 1980s by Professor Bogduk, Nikolai Bogduk from Australia. And probably the evidence is second to none in terms of treatment. Again, if it's done precisely, if it's done by the book and we do things by the book, going to the anterior column of the spinal column, of course, the discogenic pain is a well established concept in spine literature.

And if the referral comes from one of our colleagues in spine surgery, and they say, "I need to do a disc arthroplasty, and I need you to identify the correct level," there is a procedure that is not necessarily pleasant, but it's called a discography study where a lumbar discography means that we put a probe into each disc and we pressurize a control pressure. We have a manometer, so we play engineer a little bit, and we pressurize that. We see the contrast dye going to the disc. We measure the opening pressure, that means the pressure that overcomes the pressure of the disc. And we pressurize the inner part of the disc, which is nucleus pulposus. And we basically put more pressure and we go over the opening pressure. There are certain parameters that are published in the literature, like 50 PSI, PSI as you do your tires, I guess. I do mine. I like playing with that. So, there were driven precise guidelines to do this procedure. And if it's more than 50 PSI, you measure over the opening pressure and the patient has no pain. So, you have a pressure of give or take 75 PSI in the disc. And the

patient describes, "Doc, I have no pain." That's a negative disc, and we stop. We take the needle out of the disc and we go for the next disc.

So, it's driven by science. And we do that procedure to identify discogenic pain. Of course, we cannot do that study for every single patient. And it's been shown that if the discography study is done by the book, the outcomes are amazing. The surgical outcomes are amazing. And that is actually a study to help our colleague surgeons and to help the patient to get just as much surgery as it's needed and not more. If you look at the pain generator as a bone or vertebrogenic pain, an ablation of the basivertebral nerve that innervates the bone and the end plate, that is a little different, because that is a non-myelinated nerve as opposed to the nerves in the posterior column that Dr. Gugger discussed about. Those are myelinated. They grow back. The front ones, they don't grow back.

Of course, there's same challenges with prior authorization, insurance companies. But I think the evidence that came out in the last five years, it's very supportive of treating the right patient with the right procedure. And again, we truly need to acknowledge the fact that we may have another tool in the box that's a good tool. And we may be able to have a good tool to treat axial back pain, which is the hardest to treat. And some of our colleagues in the surgical field are not very excited about.

Host: Because you'll be replacing what they do with what you do.

Dr. Adrian Popescu: No, no, no, that's not true. I meant it when I said it, the axial lower back pain, you can ask eight out of 10 surgeons that would rather have something conservative done first before they do fusion of that segment.

Host: This has been very helpful. You've given us an understanding of the various aspects of these procedures that we don't know too much about. Now, some patients are coming and getting spine stimulators and other technologies. Can you educate us about some of these things and if there's anything else that we haven't talked about that you think has value?

Dr. Douglas Gugger: I think that a couple of things that you may hear, one are spinal cord stimulators, peripheral nerve stimulation, intrathecal pumps. And then, there's a whole litany of other kind of procedures that pain and spine doctors are performing, primarily on private practice, which, you know, are various degrees of interspinous spacers. There's a whole litany of things that they're performing that we don't necessarily do here. And that's primarily to Adrian's point, that we try our best to operate within evidence-based practice as

well as operating within the global context of the fact that we work with some of the surgeons and some of the procedures that are done in private practice. I don't think that they are sanctioned by certain surgeons, because there's a whole host of complications that may kind of befall patients that is probably not best within our jurisdiction and nor should it be.

However, things that we do provide here are we do a fair number of spinal cord stimulators, and we are delving into the idea of a peripheral nerve stimulation. And that had historically been for more of our, you know, peripheral neuropathies. And Adrian, you can correct me if you feel otherwise, but there's some evidence that utilizing peripheral nerve stimulation for those individuals with axial back pain and targeting the medial branch nerves using the peripheral nerve stimulators, there's some evidence, not awesome at this point in time admittedly, that we can use it to treat those patients with facet joint disease without actually ablating the medial branch nerve, which is in some patients helpful.

There's a whole group of patients we didn't mention that may have spondylolisthesis, and there's some movement in the spine. And the one area where an ablation may kind of cause an issue is it reduces some of the muscle tone in those areas. The one or two muscles that it actually innervates that you probably need in those cases, it may reduce the effectiveness. So, some experts are using peripheral nerve stimulation along those nerves, and it's only implanted for 30 to 60 days, after which it's removed. And there is some evidence that at 12 months, they still have meaningful pain relief. Now, that it's a very small sample size but the data is encouraging. So hopefully, we see more progress in that avenue.

The other group is spinal cord stimulators. And I'd say that we typically put those in for patients that have had, let's say, a large fusion, and still have significant radicular symptoms, or what we typically refer to as post-laminectomy pain syndrome and just have refractory pain following those surgeries. And the device basically is similar to an epidural catheter that our wives probably have with pregnancy. We place it under image guidance, and it has eight electrodes on each lead. And it's implanted on the dorsal column, so where all the sensory input from the peripheral system transits through. And the idea is by using electrical stimulation through various programming, whether you're changing the amplitude, pulse width, it kind of varies from program to program and device to device. But you're essentially trying to reduce pain in that regard. But we are using them. It's more for the patients that have been refractory to other modalities and have had surgery typically are the places that we'll be utilizing those kind of modalities.

Host: Adrian, I'm going to give you the last word here. Is there anything that we haven't talked about that you think that has good evidence that we should all know about in primary care?

Dr. Adrian Popescu: Again, a precisely done procedure approaches the outcome that is as good or better that is published in different settings. And I'll just cite, even though we talk about back pain in terms of neck pain, cervicogenic headaches, the radiofrequency ablation of the nerves that innervate the Z joints or the facet joints. If you look at the study published by Bogduk and MacVicar in New Zealand, Australia, they said 70% of the patients have excellent outcomes and they define that as no additional medications, no further medication treatment, complete relief of pain, return to work, complete functional recovery. So, very few things that we do in medicine can approach those very strict outcomes. And I always encourage my colleagues and our trainees to try to perform the procedures the way they were described and using the same tools.

And I think we have all the tools here at Penn. We are very fortunate. We have end of the year conversation and a little graduation party every year with our fellows, anesthesia-pain fellows, spine fellows residents, and I always said it, we are really privileged, because we as physicians at Penn Medicine, we can do the right thing every day. Not every physician is privileged as we are, because we can. We have the right tools, we have the right technology, we have colleagues that are very collaborative, and we are literally a text away and a phone call away. And many times, I reach out and I say, "Hey, listen, I have this problem." And the other person would drop everything off and say, "Okay. Let me take a look," which is unique. And we should be very happy.

Host: This was really helpful to help us understand what was previously a black box to us about what happens when we send patients to you for these procedures. And, you know, at some point, maybe we can have you come back and talk about the cervical spine as well and some of the elements of that that are different from the lumbar spine. Thank you for coming on the podcast and thanks to the audience for joining the Penn Primary Care Podcast.

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