# When Should You Have Surgery For Adult Onset Scoliosis: Video Transcript

Dr. Beckman (00:05):

Okay. Hello everybody. Welcome to the Centura Grand Rounds. I appreciate everybody taking some time to come by and listen to my lecture here. Let me get everything started. So the lecture is low back pain and new X-ray findings of a spinal curve, mainstream and alternative treatment options. So I want to start this by going through a content outline. This lecture is designed for a non-urgent audience, so I hope that maybe some surgeons will get some benefit out of it. And we're going to start off with just an introduction into spinal curves and adults. But the main point of this is to concentrate on the small spinal curves and we're going to have a brief review of the different scoliosis types and kind of discuss why there are so many. Then we're going to transition into actually evaluating a lumbar radiograph or a lumbar x-ray review, specific measurements that can be easily done on anybody's computer.

(01:02):

Then we're going to move on to try to discuss the origins of adult degenerative scoliosis. It's not studied that well, but we're going to look at kind of disc and face pathophysiology and questional genetics. Then we're going to do a case study evaluating a new patient with adult degenerative scoliosis to kind of go through that process from a non-surgical perspective. And lastly, we're going to discuss the mainstream treatment options, which is classically large thoracal lumbar fusion. And then spend a little bit more time looking at alternative and novel treatment options such as short segment constructs, where we recreate the neutral segment of a vertebrae, and then also discuss neuromodulation or spinal cord stimulator placement for adults with degenerative scoliosis disclosures. I have no disclosures. A little bit about me. So my name is Josh Beckman. I'm a board certified neurosurgeon. Here you can see a picture of me in uniform with my little girl.

(01:58):

She's now almost two years old leading the way I was giving her and my wife a tour of the hospital. And so a little bit about my experience. I was previously the chair or vice chair department of neurosurgery for San Antonio Military Medical Center, which is the largest department of Defense Hospital in the us. We were a level one trauma center. We saw civilians, retirees, beneficiaries, just kind of all comers. During my stay there, I was the director of spinal surgery. I was the director of spinal oncology there. My main specialty as kind of in minimally invasive and lateral access surgical TE techniques as we all do, anybody who presents here, we've got plenty of peer reviewed publications book chapters. I'm a routine contributor and Dr. Greenberg's handbook of neurosurgery, which he is one of the nicest human beings I've ever met and the multiple national international oral presentations.

(02:46):

And I think the most important thing is today's day. So happy Veterans Day to all the veterans out there. And if you know someone who served, please say thank you. They've gone through more than you can possibly imagine and for very much. And so they really dedicate their lives to serving this country. And from the bottom of my heart, I appreciate everything that everybody does. So moving on what is considered a spinal curve. I got some pictures here that I want to share with you. So this is a picture of adult gur scoliosis and this is a very easy thing to pick up on and not the point of this lecture, but I did want to share some insight with you. Some people's like is this a left-sided curve? Is this a right-sided curve? But it's really easy to determine the difference between that if you just draw an arrow right here and that's pointing toward the left side.

(03:33):

So that's a left-sided curve. Another aspect of this is another curve. So this is the right-sided curve. If we draw an arrow here, it points to the right. This patient also has a lateral essis, which we're going to go into detail, but once again, these are very easy to pick up. You see these if you're not a spine specialist, they probably need a referral to a spine specialist. And lastly, this is an elderly person with a progressive curve. Easy to pick up is nothing to manage. The discussion here is not about that. What we are really interested in is early diagnosis of a spinal curvature meaning this picture right here, this is a patient of mine that I saw recently. This is her initial films from two years, two years ago, and this is the more current one. And the idea here is to have someone look at this and evaluate and say, is there anything that we can do about this besides a one or two level fusion?

(04:31):

And that's kind of the overall conversation that I want to have as we go through this topic. And the idea is to stop the curve progression before it gets to here to where you may need a longer construct. So continuing on quick definitions of a spinal curvature. So scoliosis is kind of a catchall term. I specifically didn't use it in this title because I didn't want people to think scoliosis. Oh, I don't want to hear about it. The main thing is looking at a very small curve like this, and if you look at the bottom left of your screen, what is the definition of scoliosis throughout all of these? Well, scoliosis is defined as a corona cob measurement greater than equal to 10 degrees. And so on the right side of your screen here, I've demonstrated what a COB measurement looks like, and we're going to go into the details of that in just a bit.

**Degenerative Scoliosis (05:21):**

We're going to talk about adult degenerative scoliosis, so scoliosis and ake skeletally mature spine but there is adult idiopathic scoliosis, which is kind of a continuation of adolescent idiopathic scoliosis. Adolescent idiopathic scoliosis is new scoliosis that starts age 10 to 18. You also have juvenile scoliosis, which is really ages four to nine congenital scoliosis, which someone is born with perhaps a hemi vertebrae and they're just born with an abnormal spine. Neuromuscular scoliosis is very common. We see this quite commonly. And let's say a patient with cerebral palsy where they don't have the ability to really control their paraspinal muscles, so they have asymmetric firing, which creates a curve. And then there's many types of kyphosis, human kyphosis, kyphoscoliosis, all these other things. But the main point of this lecture is a small curve, understanding how to assess it and doing case studies and looking at different treatment paradigms for it.

(06:16):

Of note, if you're looking at x-rays, I just want to point this out is that anytime you see an x-ray and you're sure unsure which size left, which says right, you're always going to see an R or an L here. And this one, so this is the right side, D L E is probably going to be the x-ray text initial. Sometimes there's a number there. And then in this specific x-ray there are little bbs right there. And so I know that this x-ray is actually supine and not upright because the bbs are gravity dependent. So they would be down here and I'll point that out as we go through, but just small things for people to learn. Okay, lumbar x-ray measurements. We'd briefly mentioned a cob angle. So a cob angle was developed by Dr. John Robert Cobb, an orthopedic surgeon, 1948 I believe. He worked in New York and he wanted to determine and track the progression of scoliosis.

(07:03):

And so how do you measure a cob angle? This is very basic, but here's the definition. I just kind of found this funny. To measure the cob angle, one must first decide which vertebrae are the invertebrae of the curve deformity, also known as the term terminal vertebrae defined as the vertebral or vertebrae whose npls are most tilted towards each other. And so in layman's terms is you find the curve and you measure the most tilted vertebrae. It's very simple and straightforward. What is the definition of scoliosis versus a small spinal curvature? Well, scoliosis, as we talked about before, is a coronal cob angle measured at greater than or equal to 10 degrees. I had a question, I was going through this with some of my PAs the other day and they're like, I thought scoliosis was 30 degrees and 30 degrees is a very common number, but the true definition is 10 degrees. Usually we start treating when they're 30 degrees, and so there's a difference there. And then where do you specifically measure and then why do you measure it a specific spot? This is kind of open for interpretation. There are some surgeons and radiologists that are very regimented and dogmatic. I'm really not that way. I kind of look at the screen, find the apex vertebrae, which would be the center of your curve and look for the most tilted segments. And then that's where I developed my chron co measurement. Okay let's move on.

(08:25):

All right, so this is a video that I took and I wanted to show the audience how to actually perform a chron cob measurement. This patient has baseline degenerative spondylosis, no scoliosis. His spine is straight. It's wonderful. He's in the seventies and we're going to briefly discuss this, but this patient has symmetric degeneration of his disc as opposed to asymmetric degenerations. And so I'm going to play this video and this is using rpac system. And the first thing that you do is you right click and you're going to get this little sub screen here and then go to annotations. And then all the way up there you're going to have arrow and then angle and you're going to click angle. Then you click and make a measurement. And right here I'm just measuring the mpl. And then you click again and make a secondary measurement and you can see that dotted line that connect the two.

(09:19):

And what it's going to do is give you an angle and you can move this line up, you can move this line down, you can increase the angle, you can decrease the angle to whatever you need to. So there's a lot of variability in this type of measurement. Now going to go to the other side. Once again, your right click, go down to annotations, go to angle, and then here I'm going to measure lumbar lordosis, which is probably the more important measurement in treating scoliosis than aro cob angle. But we're talking

about just diagnosing it. And so here you can tell that all it does is it draws an angle between the two lines. It imagines that the lines are connected and they have 48 degrees of lumbar lordosis, which is completely normal and it has almost no spinal curvature. So this patient has symmetric degeneration of his disc generalized spondylosis.

(10:11):

Okay, the next video, so this is a video. Once again, I think repetition's key if you don't know how to do this, and I'm sorry for those that already know how to do this, but you right click go to angle. And this patient actually does have some scoliosis. So I'm looking at the measurement, I'm assessing the actual vertebrae here. I'm like, all right, well this looks like the lowest tilt in angle right here. And so I'm drawing a line and then I'm going to go all the way up to the top here. I'm going to draw a secondary line and what I suspect is how the vertebral body looks, and this is going to be at 10 degrees. So by definition, this is considered a scoliosis. Now another interesting component here is if you look at the patient, and this is a very subtle finding, they're actually tilted to the left side and they have something called a fractional curve, which is a whole nother type of conversation.

(11:00):

But here I'm drawing a straight line up to determine how far over the patient is tilted because this is helpful in clinical decision making. And if you actually draw the sign, it makes you look. It's like wow, they actually are really tilted to the left side. And so if there's ever concerned, it's like, man, do they have scoliosis? Do they notch? Do they see someone? This is a very helpful way to look at things. And you can tell here that the vertebral body is almost completely outside the midline, which wasn't quite obvious when we first looked at this.

(11:32):

Okay, continuing on with a lumbar x-ray measurements, there's only two that there're going to go over in this lecture. There's plenty, but we don't need to discuss something. So lateral lassis, so what is lateral lassis? It's essentially a lateral slip in the spine. We do have anterior and posterior lassis called a spondylolysis. It takes time to learn how to say that I practiced when I was a resident but lassis really means to slip or slippage. And so how is a lassis measured? Well, it's measuring how much of vertebral body has slipped over the body beneath it. And so this radiologist did a really good job and they measured almost a 15 millimeter lateral slip of L three on L four, which is really important for us in predicting disability and surgical outcomes. There was a recent study published this year in September. Very good study in the general neurosurgery has said lateral thac, lumbar lassis as an independent predictor of disability and adult scoliosis, patients multivariate assessment before and after surgical realignment.

(12:34):

And what their conclusion was is that lateral listhesis is associated with worse baseline disability among scoliosis and then resolution of severe lateral listhesis falling deformity correction was an independently associated with increased likelihood of reaching minimal clinical important difference at ODI I to your follow up. And so what that's saying is if there is a significant lassis like there is in this one you have to correct it or it'll affect your outcomes and it's an independent predictor of disability. So by definition, this patient is easily a surgical candidate. And then some people may be wondering, well, how do you correct a hour? I have an intraoperative video here that we'll review a little bit later, but this is a PA or

an AP fluoroscopic radiograph. And this is a video of me correcting someone's lateral listhesis intraoperatively. This is from a lateral approach, but if you look at this video, you can see that the vertebral body is actually coming back in the entire top of the spine is moving and relationship to the bottom of the spine.

(13:36):

So in essence, we're correcting a severe lateral thesis, which is really, really interesting. Okay, moving on pathophysiology. Why do some people develop adult degenerative scoliosis and others? Well, if we look at it, I always tell my patients about three things, time, gravity and genetics. I tell them, I say, listen, there are two undefeated entities in this world, time and gravity. They always win no matter what. And genetics, unfortunately, you're kind of just born with and there's nothing you can do about it except modify your risk factors. So we go on and we look at symmetric degeneration of your disc, meaning that the disc goes through and instead of going asymmetric, it goes symmetrically. It's very straightforward like that first patient that we saw. Now the main thing that I would like to point out is that this is just a vertebral body segment. It is symmetric degeneration.

(14:30):

Notice how the disc is bulging everywhere, but it's not asymmetric, it's everything's equivocal. So if you look at asymmetric disc degeneration, what we think this is a result of, there hasn't been that much that's studied. It's kind of papers here and there that continue to quote the first paper who studied it. But we have small microscopic ular tear starting at age 15 or maybe sooner if you're more active as a child. And then what this does is it creates scoring or vascular end growth. Well, when you create scar around the annulus, as we know, the nucleus ulus is an avascular structure, and so you get diminished blood flow around it, so which further inhibits nutrients. And then when you get diminished blood flow, you get decreased nuclear cell density. And so when you get decreased nuclear cell density, it doesn't typically occur in a symmetric fashion, it occurs in an asymmetric fashion which leads to an osmotic balance change, and then all of a sudden you have degenerative disc changes that are asymmetric.

(15:25):

And so once you start developing some asymmetry in this picture right here then you have your gravitational vector that runs straight down and so all of a sudden the majority of your load is on this patient's right side and then it just creates this vicious cycle. As time progresses, it gets worse and worse and worse. So risk factors, smoking is a risk factor for everything. Everybody knows that if you're a smoker, you're an increased risk for pain deformity, D V T, you name it. Obesity, obviously you have the mechanical load that increases the gravitational vector, which furthers the vicious cycle, but also it increases the production of lap leptin. leptin is a peptide hormones treated by fat and it is sought to activate pathways that can be detrimental to disc integrity. So I tell my patients, I know it's really hard you're in pain, but try to stay as lean as you possibly can. And then osteoporosis. So osteoporosis used to be thought as an independent risk factor for scoliosis but there have been multiple studies to show that actually if you look at patients side by side, there's no increased risk of scoliosis. And so you had a preview to this. If you watch college football, this is my buddy Lee Corso, not so fast my friend.

(16:38):

Okay, so spinal progression over time, this is a really, really nice study out of South Korea and it's looking at the progression of a scoliosis curve and we don't have very much evidence to document this, but what we think is about three degrees per year ranging from one to six. So if you take a look at this side, 1994 versus 1999, you have essentially a stray curve. And then in 19 99, 5 years later you became beginning to have adult degen scoliosis right here. And you can specifically see the asymmetry at what appears to be the L world five disc level. Then fast forward six years later, you got significant progression of the curve, you're having lateral osteophytes. Now you have a true lateral lassis right there, which as we remember is an independent risk factor for disability and then progress one year later, you have a significant progression of the curve.

(17:30):

That's probably 10 degree progression which is out of that threshold of one to six per year. And so that is really important to pick up. And I think right there is the major part to pick up on. So if we look at their second patient that they presented 1996, this is a very moderate small curve. And then you go to 2002, well maybe just a little bit of progression that's right on that one to three degrees and then from 2002 over two years you have a very significant progression developing a lateral osteophyte and overall generalized spondylosis. And then what I find really interesting is from C to D, there is a little progression, but it's not bad. And the difference between C and D here and C and D here is pretty impressive. So there are risk factors there that we may not know about such as smoking and obesity as we age, unfortunately we've become less active in which contributes to that vicious cycle.

Dr. Beckman (18:21):

So the overall goal of this is not to discuss these, but it's to discuss this and this. And let's say that we are able to evaluate a patient that transitions from here to here and has really bad axial back pain and I go in here and I correct this level, then maybe I can stop the progression and we'll look at some images and postoperative follow up looking at that. And so please be on the lookout for these small types of cures even if they're not 10 degrees. Okay, so early patient education, here's a case study, a 56 year old female with mild back pain for about two years here to see anybody for routine follow up, primary care or neurosurgery orthopedic whatever. Her pain is improved with Motrin. She's fairly active and what she wants to do, she wants to walk her dog and she's having trouble walking more than four or five blocks.

(19:14):

And when you see her, the B X-ray is the one that you actually get today. And then the a x-ray is the one you had two years ago. And so now you have this patient in your office, this mildy symptomatic, and I wanted to go through some questions to kind of ask as you go through. So is the patient mildly symptomatic or they have a progressive symptoms in this patient case, I would say that they're just mildly symptomatic. Continue with Motrin and let's get another x-ray. And then that leads to the second question, how often should I order? I think if you see scoliosis but they're asymptomatic, you should absolutely order yearly x-rays to start seeing that progression and you can start the conversation with the patient that way they don't get to that major curve and all of a sudden they're seeing a spine specialist like, oh my gosh, you need a big surgery.

(19:57):

Another question, is there a lateral thesis? We looked at that earlier. Independent risk factor for disability. So keep your eye out for that one. Has the curve progressed or is it stable? And this end since the curve has progressed, but the relatively asymptomatic so you can continue to follow and then you're talking about it, you're showing with patients and you're like, all right, well we're going to send you to physical therapy. There's no contraindication to physical therapy with any type of scoliosis curve. One of the questions that commonly get asked is, is PT going to help correct the scoliosis? And the answer is no. This is a degenerative phenomenon. Remember time and gravity, two undefeated entities, it's not going to correct it but I do tell them it's great for core strengthening exercises and you may be able to slow the progression on the curve though we don't have any evidence to study that right now or we don't have any evidence to support that.

**Should you use an inversion table for scoliosis? (20:49):**

That's just what we think. And then what about lumbar traction? So that's a great one. I think lumbar traction is fantastic, but remember time and gravity, those are the two major A factors. So it'll transiently release your curve, but as gravity reloads on your axial spine, then you're going to come back to your regular curve. I had a patient on Monday that literally went through this list before I made it and I was like, man, I really want to videotape you for this lecture. But he asked me about lumbar traction pt and then I had an inversion table. He's like, doc, I got an inversion table off of offer up or something. And he is like, can I use it? And I was like, sure, you can absolutely use a traction table or an inversion table to, and if it helps, then perfect, keep going.

(21:31):

If it doesn't help, then don't use it. But eventually it'll just transiently offload your spine. So if you're feeling better with it, that tells me that you're having pain associated with your adult degenerative scoliosis. Another important question to ask is back pain, leg pain or having both. There's a huge difference between back pain and leg pain. And I consider blood pain and the leg pain paradigm because that's, say we had this patient right here who's having purely leg pain. Well instead of doing a fusion on him, we can potentially go in through a tube and just do a small laminotomy and free up the nerve roots that are compressed on the concavity of the curve. So that's a really important one. Back pain that one doesn't help so much with. And then a question, when should you see a spine specialist? I think that if you see any type of curve or progression of a curve, I think that you should certainly have the patient see a spine specialist that they can at least establish care. It doesn't really mean they need surgery but it's good to know someone for a few years and see their curve progress and then have that conversation and a rapport. I think patients do much better that way.

(22:36):

So this is a great transition. Operative versus non-operative treatment for adult symptomatic lumbar scoliosis. When I was we have to take continuing me medical education for our board certification every year and going over this paper was one of our requirements and this was a really fantastic paper published in 2017 and it had essentially two columns of treatment. It had randomized perspective follow up patients randomized under operative treatment and non-operative treatment. And they also had an observation cohort where they looked at people who didn't undergo surgery and who did undergo surgery. And essentially it said that on the basis of as treated and minimally clinical important difference analysis of a patient with adult symptomatic lumbar scoliosis is satisfied with a current spine related

health non-operative treatment as advised and with the understanding that improvement is unlikely if the patient is not satisfied with the current spine health and expects improvement in surgeries preferred.

(23:36):

So essentially if the patient's doing okay, then they're doing surgery is not going to help them because it's really hard to keep them, take them from a good baseline and make them better. But if they're slowly progressing and you operate on them, then they can come up to a better baseline when it comes for s r s satisfaction, O D I and I think VAs in this study. So another interesting component was in the randomized cohort where they went from randomized surgery versus no surgery, they had a 64% crossover. So there's good evidence to tru treat people who are in pain and do not doing well on conservative management.

(24:13):

So treatment options for adult degenerative scoliosis. Well these are two, this is a patient of mine this patient came to me and an advanced stage. She has a pretty significant current, it's a moderate to severe and the classic treatment is a T 10 de pelvis fusion. And there are a lot of different ways to accomplish this task and some ways are better in surgeon's hands, some ways are better than other surgeon's hand. And so you have the difference is an open surgery versus purely minimally invasive surgery. You also have this hybrid and it's a combination of open approach and minimally invasive approach versus the classic open approach and then you know, can either further delineate this into open anterior posterior versus pure posterior only. So we have all these subcategories and when you go through it, you know, kind of look at this and you're like, all right, which approach is better?

(25:03):

Is it open m i s hybrid, all posterior combined? Anterior posterior. Well with anything in medicine and surgery, this is a highly debated and controversial and even emotional subject. You know, you'd be surprised you'd go to some of these conferences and listen to some really big names speak but there have been some studies they're all level three in level four evidence, but they stated that minimally invasive patients actually leave the hospital earlier and have less blood laws. And then the mis S constructs minimally invasives surgery constructs tend to have lesser levels fused, but also less correction, meaning that the correction and their lumbar lordosis and coronal curve is less than the open procedure.

(25:47):

And then the i s also take longer but have less blood laws. And so that makes sense. I s surgery, let's take for instance tying your shoes. If you just tie your shoes normal open, then you can do it fast, easy, you can see everything. But with minimally invasive surgery, imagine tying your shoes through a little box about that big it's going to take a little bit more effort and a little bit more skill or maybe not a little more skill but just a little bit more understanding of how to work in those confined environments. And that's why sometimes I surgery takes longer and I always say the patient is much harder on the surgeons, better on you when you do m i s surgery. And then looking at this open and m i s surgeries have similar outcomes at two years. So if V A S O D I and the revised S r s, which is scoliosis research Society 22 form.

(26:33):

And so Evans, my own opinion is that there is no perfect surgery, there's too many variables. You can see what was their curve before surgery, what was their curve after surgery, what's their fragility index and all these variables that we try to do. And we got T1 angle, all these different variables. And so what I really think it is, it's highly dependent on the surge training and complication profile. There's some surgeons that are amazing at opus effusion that have fantastic results as long as the surgeons are submitting their data to national databases and following our outcomes and they're having great outcomes and that is fantastic. So there's no one right way to do this, it's just based on the surgeon, their training and their capabilities. Alright, this is kind of my favorite part. Now this is the fun part. So alternative treatment options for adult degenerative scoliosis.

(27:20):

So what happens when we catch scoliosis before something or before it progresses to a major curve? So here's a patient with a small right-sided curve, okay? If you draw an arrow right here, it points sorry, left-sided curve that points to the left side. And then this is the progression. Over two years we went over this and then here's the progression 10 years later. So now the patient is too old, the fertility index is too high. So there's nothing really I can do to fix this curve. So here are the questions. Can a smaller surgery stop the progression of the spinal curve? And we don't know the answer to that quite yet. And one in the spine proverbs that I always say I heard in residency you go to any of these national meetings is you're either creating deformity or you're fixing it. So for instance, to this patient gets just a one or two level fusion then stops at the apex of the curve without correcting deformity while you're almost 100% guaranteed to get something adja, something called adjacent segment failure, more pain and more surgery.

(28:19):

And so the idea is well maybe if we stop the progression on the curve, we can slow down that process. And the question is what happens if you pull the apex of the curve into normal alignment? And so let's look into this further good transition here. Here's a paper I wrote and I think it was published in 2017. Does m I s surgery allow for shorter constructs and the surgical treatment of adults model deformity? Really nice study. It is a retrospective review. We had two patient cohorts that were propensity match one at a center that did open surgery and then another center that did purely m i s surgery. And our conclusion is if you look down here is that i s techniques for adult spinal deformity may reduce construct length, reoperation rates, blood loss and length of stay without affecting clinical and radiographic outcomes when compared to a similar group of patients treated with open techniques.

**Lumbar Lordosis (29:14):**

And so that was a really jumping off point for me in thinking about how to pursue adult degenerative deformity. One of the things that really stuck out to me, and I mentioned this earlier, is that there is a significant difference in postoperative lumbar lordosis 43 degrees versus 49 degrees and pelvic incidence and lumbar lordosis correction 10 degrees and 5.2 degrees. And we haven't discussed those parameters because the idea is not to discuss the treatment algorithms, but those are the main indicators of functional outcome scores after surgery. So with MIS S surgery, you had less levels but you had less correction, which makes sense, right? Because you're working through a smaller corridor and

it's all based on engineering of the tools. And I thought about this and I was like, well if M I s, if you can do it and also give good correction, then maybe the patient outcomes will be satisfactory.

**Can you correct a curve through an MIS approach? (30:05):**

So can you correct a curve through an MIS approach? Here is an interesting case study. This is a patient of mine that came to me with low back pain and radiculopathy and she had a progression of his curve of her current. And you can see right here if you look very closely, I'm sorry, the image is not as detailed, but she has a lateral lassis of L three on L four. And what I did is I drew a line looking at the vertebral level that was not fu then what I did is on minimally invasive surgery, the lateral approach and corrected that lassis. Now if you look at this, her curve is not completely corrected, but her level above the curve is neutral now, whereas it was not neutral. And so the thought is is that if you can make that segment a neutral segment, then you stop or at least slow that vicious cycle down. And this is four years after surgery and she's doing well. So if you remember this video, this is where the video came from. And so if you look at this, you can see the correction through the side approach or the lateral approach the side of the vertebral body's there and we're using a lax screw to pull that deformity over there and you can see the entire spine regain height and correct the lateral listhesis.

(31:24):

Okay, here's another case study. So you remember this aspect, we talked about lateral listhesis and how important that was. Here's a patient with a right-sided lateral listhesis. Notice that this image is upright. You can see the L delineates, the left side elevens probably the text name. All right, so can you correct the curve through an M I S approach? Well, this is the apex of the curve right here. And if you draw a line through the center of it, this is a pretty far right-sided curve. And the classic way to do this would be to do a T 10 to pelvis because that's the way we're trained. But extrapolating the paper that I was involved with, I was like, well maybe if we do this all MIS and make the apex of the curve an actual neutral segment, then we can save the patient a significant fusion.

(32:11):

And so you look at this and I'm like, okay, we make a post right here and then if I can bring the vertebral body over to the patient's left side and make that segment a neutral segment, then maybe we can help them with both their pain and mobility. And so here's the outcome of the surgery. I was able to use a pelvic bolt cause you have a really good foundation, something called a cold bolt home rod and I just pulled the entire spine over. And now if you look at this, this is the segment above the fusion, it's neutral. Now he still has some curvature to the left side because that's what he is had and it takes a while to accommodate for it, but it's a neutral segment, it's at zero degrees whereas before it's probably at 15, 20 degrees. And so this patient I have three and a half year follow up on and he's doing well now he is developing some adjacent segment failure right here because he's an active guy and he's about six 10.

(33:02):

He's ultra tall, so he has a little bit more weight on him, but he's overall very happy. I suspect that he will need another surgery at that level, but if I can save him half a decade from going up to T 10 to pelvis, and I think that's a true win. All right, so continuing on alternative treatment options for adult dys scoliosis. So what is the difference between the two surgeries right here? Well, this patient got to a

spine specialist later in the game or she didn't want surgery or she was refractory to any other intervention. And so unfortunately she had to undergo a larger fusion construct. And as you can tell, this patient's actually tilted a little bit to the left and that's okay. It's not about the criminal alignment, it's about the SA alignment, which I'll show you later. And this patient got too relatively early in the game and was able to perform a much shorter construct.

**Early Detection of Adult Onset Scoliosis (33:51):**

So early detection I think is the key, having a conversation, developing a rapport with the patient and having true discussions about what's going on. And so looking at it, we're talking briefly discussed Saul alignment. So if we look at these different curves I've drawn out and look on the right side of your screen here, this is a relatively flat back compared to what it should be. So the lumbar lodosis is low the sacral alignment is intact, but she has thoracic kyphosis meaning that she's trying to compensate. And so after surgery she has a much more anatomic curve and you can tell that she has relaxed in her thoracic spine and she's still relatively aligned, meaning that her ears are above her pelvis. If we looked at this surgery, which is in the counterpart, the lateral angiograph to the ap once again relatively flat back right here, there's no curvature.

(34:43):

And then after surgery you can see a line drawn through the mid vertebral bodies and they have a fantastic curvature. And so not only is it coronal, but the most important thing in this is sagal alignment, something called lumbar lordosis, pelvic incidence in the delta between them. But that's certainly for another lecture. But I briefly did want to mention it. Okay so to recap, can you correct a curve through an MIS approach? Well, I think the answer is absolutely. You got to have a creative thought process. You got to have a really good patient understanding and good discussion between the surgeon and the patient. If you take the apex of the curve and then pull it to a neutral segment. And then I think that provides some benefit to the patient. What are the major risk factors? If you talk to any type of deformity surgeon adjacent segment value or something called pjk, proximal junctional kyphosis is probably the thing that we fear most, meaning they break down the level above which we refuse.

(35:35):

And so if you look at adjacent segment rate and deformity, and there's a really nice review of this as was recently published I think in 2018, but the failure rate is 20 to 40% in a T, 10 to pelvis. And so that's a really, really high. So my feeling is that whether it's surgical or not, it's still people fail after these big open deformity surgeries at a high rate despite what we do. And we're always trying new therapies to try to mitigate that. And then you ask yourself, well what is the adjacent segment failure rate in a short segment constructs? Well, we don't know the answer to that because that hasn't quite been studied. And so we communicate this with all of our patients tolerance for mobility. The first time you do a T 10 to pelvis, you see the patient in the postop, they're like, doc man, I feel pretty good but I can't tie my shoes.

(36:26):

And they're working on trying to get mobility. So you really minimize someone's mobility. As a matter of fact, I had a patient yesterday and he was 68, very active guy likes to work on his truck climb, hike and everything else and he was actually wanting a tee 10 to pelvis. And I was like, man, you're not going to

be able to do any of that or it's going to be really hard for you to do that with a big surgery. So you got to think about mobility and you ask the question, would you rather have better mobility with a short segment construct at the cost of potential increase risk of further surgery because we don't know the rate of degeneration with a short segment construct and adult degenerative scoliosis. And that's something that I plan on studying in future prospective studies as we go forward.

(37:08):

So we can have answers to those questions. Moving on, so the last alternative treatment for adult degenerative scoliosis is neuromodulation, also known as a spinal cord stimulator. This is also poorly studied in adult degenerative scoliosis because I think sometimes the patients get large surgeries before they get access to this type of therapy and sometimes that's not the case. The reason I like this is that it is a completely reversible therapy. So that patient I was talking about yesterday, I actually talked him into a spinal cord stimulator trial. He had a fantastic result and we're going to do a spinal cord stimulator with him. The patient undergoes a seven day percutaneous trial lead and either they're benefiting from it or they're not. And the vast majority of times they do receive some benefit. And so when should you consider a spinal cord stimulator to someone? Well, you look at the fragility index, that's another preoperative indicator that we use for looking at adult degenerative scoliosis.

(38:04):

Is their fragility index a contraindication to surgery? What happens to a younger patient that has a small curve but there's no progression and still has pain? So I think that a good first line option for them may be a spinal cord stimulator because guess what? If the spinal cord simulator doesn't work, you put it in, it works for two years and they come back to you, well you've given them two years and you've tried everything and then you can pursue fusion surgery. Secondly, when to consider the patient's, not a surgical candidate. One of my happiest patients I've ever had is he had two double lung transplants and he had severe scoliosis and really bad back pain. Obviously he's not a candidate for any type of fusion surgery. And so we put a spinal cord stimulator in him and he did fantastic. He still texts me every year saying how well he is doing. So I was very happy about that. And then lastly, in some of these patients, since it's a reversible therapy, it can be considered a first line therapy and anybody, you just got to have a discussion with a patient and it's a really interesting group of patients. It is a huge dichotomy. I had one patient the other day say, so wait, you're telling me I don't have to have fusion surgery?

(39:13):

This is an outpatient surgery and it has potential to help my back leg and knee pain. Sign me up immediately. And then you get the other side of that and you have some patients that say you're putting electrode on my spine, is it going to malfunction and shock me? Are they going to be able to track me? And all this other odd questions. And so there's a huge dichotomy and dichotomy in that patient population and some of 'em benefit and they go through psychologic testing and others don't. But I think it's an option to consider, especially for scoliosis. Alright, well that really concludes my lecture here. This is a picture that I took on a hike probably in early November. It's beautiful. Here are my email addresses, so please feel free to reach me by email if you guys have any questions or concerns. And I think maybe we have some time for questions. I'm probably running a couple minutes early, which is always good with c M E and thank you.

(40:17):

Just a reminder that you can ask your questions via the chat function or you can also unmute yourselves and ask,

(40:26):

I hear a kiddo in the background.

(40:28):

Okay, you can go ahead.

(40:32):

Can I get a question? Can you hear me? Hello? Can you hear me?

Speaker 1 (40:37):

Yeah, absolutely.

(40:38):

Hi. So I'm an 81 year old practicing medical oncologist in actually superb general health. I discovered a couple years ago that I had a lumbar scoliosis based on a CT study. I had no idea that I had that. And it's virtually asymptomatic. It's not, it's no more than mild to borderline moderate, let's say mild. I do note that sometimes in the morning after sleeping eight hours my back, low back will be a little bit sore, but up and around it's fine. So I'm listening to your talk, I'm concerned about progression and wanted to ask you a question about what are lumbar support courses of any value or what I might do to try to keep it from progressing.

(41:24):

Yeah, I think that literature especially with adult I'm sorry, adolescent idiopathic scoliosis, I mean they have custom braces that stop progression on the curve. And so let's say we have two different types of off-the-shelf braces. You have a TL S O brace, which is that brace that kind of comes up here. And sometimes you see patients, I'm sure you've seen it before, where it goes up to their neck or just an L S O, which is a lumbo, sacral orthotic. There has not been any evidence that said it's slowed the progression of the curve probably cause they haven't studied those. And it's really hard for the custom fit braces in adolescent pathic scoliosis to really stop the progression as well. So my suggestion would be to try it, especially an L S O brace that fits pretty well and follow it and if it helps, then continue to wear it. If it doesn't help, then you're relatively asymptomatic and stay as lean as you possibly can and modify the risk factors that you can. I wish there was good studies, but there's unfortunately not for that one for adults anyway.

(42:22):

I appreciate that. So do I have to see a physician to get the prescribed or could I go directly to an orthopedic supply house?

(42:30):

It's cheaper for you to go to Orthopedic Supply House or even Amazon. We send patients here to our orthopedic place and they're like this is going to cost you $300, but you can get an Amazon Prime delivery a hundred dollars. It's amazing how this works sometimes, right? Yeah. But feel free to reach out and any other questions I'm happy to help out with.

(42:51):

Thank you. Appreciate

(42:52):

It. Yes, sir. All right. Any other questions out there? Not a lot of questions. This is fine Moderators, do you guys have anything?

(43:29):

No, I think we are. I think that's it. I will be. Thank you so much Dr. Beckman, for you presenting today.

(43:38):

Yeah, absolutely. I appreciate you guys having me. It was a true honor, so thank you.