

Orthopedics

This Week

Using Robotic Assist Devices in Spine Surgery

ROBIN YOUNG

Jeffrey Goldstein, Chief of Spine Service for education and Director of the Spine Fellowship at NYU Langone Orthopedic Hospital, formerly known as the Hospital for Joint Diseases, (one of the top hospitals in America and the only one to receive top rankings in all three musculoskeletal specialty areas by *U.S. News & World Report*) is on everyone's short list to review new technology.

He was a pioneer in the use and testing of disc replacement implants, early in the adoption of minimally invasive spine surgery techniques and this year's President of the International Society for the Advancement of Spine Surgery. He has also been a robot skeptic.

Until now.

Robot assist devices in the OR are a new phenomenon. Robots to fabricate cars—old hat. But robots to repair humans...skepticism is a logical default position. And Dr. Goldstein has been a tough customer for the companies promoting the latest robots.

So, what changed?

We met with Dr. Goldstein at the NYU Langone Orthopedic Hospital in the heart of lower Manhattan for a candid discussion about these new surgical robots.

We started by asking him to describe how his thinking has evolved over the past decade.

Dr. Goldstein: "It was funny when you asked me about the evolution of my experience with robots. I remember sitting down-



stairs nearly a decade ago and having somebody from the first spine robot company, Mazor, come in and show me this thing that looked to me like a soda can."

"My perception then was that it was designed for revisions surgeries where you couldn't see your landmarks well or for long deformity surgeries. At that point we were very comfortable with putting screws in



open surgery. I frankly wasn't sure how it was going to help me. I just imagined this slowing me down. It wasn't until maybe the past two years that I started seeing a place for robotics."

OTW: Do you think the companies actually got smarter about indications or do you think your practice changed? Maybe both?

Dr. Goldstein: "I think initially it was: 'Let's take this robot and help you put a screw in.' But we know how to put a screw in. I think when we started doing minimally invasive spine surgery, initially tubular surgery, that was probably when I took another look at robotics. Minimally invasive spine surgery, which is different than the micro-discectomy cases, meant doing fluoroscopically guided surgery with percutaneous



pedicle screws. This was a big advance. The evolution from open surgery to minimally invasive surgery to robotic and navigation guided surgery set the stage for robotics.

OTW: Image-based navigation—tying in with some imaging source?

Dr. Goldstein: Fluoroscopy is tied in with imaging source, but using an image guided robot allows for increased precision and accuracy and smaller incisions, faster surgical time, less blood loss, potentially better outcomes. Certainly, at the top of the list is less radiation for the surgeon as well as the staff and the patient. More precision, greater accuracy, faster/less radiation.

OTW: When you saw the early spine robotic systems—the little Coke can...

Dr. Goldstein: I always saw pictures of it in a green light, so I thought it looked more like a 7-Up can.

OTW: Did you think this would reduce radiation, improve precision through smaller incisions?

Dr. Goldstein: I thought it would just slow me down. I just couldn't grasp how it would fit into my practice.

OTW: Do you think the growth of minimally invasive surgery in your practice was a significant driver to your eventual adoption of robots?

Dr. Goldstein: I have always done degenerative surgeries and as those surgeries became more minimally invasive, the robot gave me the opportunity to do them better.

OTW: Mazor pioneered spine surgery robots. But there are new entrants most notably ROSA (Zimmer Biomet) and ExcelsiusGPS (Globus Medical, Inc), for example. Have you had a chance to use either of these new entrants? What are you finding so far?

Dr. Goldstein: I've explored Mazor's robot and Globus' Excelsius GPS. We adopted the Excelsius. Excelsius offers the opportunity to do minimally invasive surgery with a robot with navigation and not absolutely require preoperative CT scan. I can certainly get a preoperative CT scan, but if I prefer intraoperative fluoroscopy or intraoperative CT, or intraoperative simulated CT, then I can.

OTW: How user friendly is the preop software?

Dr. Goldstein: The preoperative/intraoperative software is very intuitive. If you can use an iPad you can use the software. If you like to play video games—we don't want to call this a video game—but it's very intuitive.

OTW: Is it as good as solitaire?

Dr. Goldstein: While I don't play a lot of video games, my son, who was at ISASS a year ago, had the opportunity to play with the software and it was very intuitive to him.

OTW: How old is your son?

Dr. Goldstein: He's 9. That's what I mean by software is very user friendly.

OTW: When you and NYU decided to take the plunge into robotics, what drove the decision?



Dr. Goldstein: I think for me it was the navigation and the opportunity to be able to plan my surgery without absolutely needing a preoperative CT scan.

OTW: Is that a big deal?

Dr. Goldstein: It is nice to have options and flexibility. Other systems require pre-op CT scans. There are certainly benefits to using pre-op CT scans inasmuch as you preplan your surgery. And with a few fluoro shots in the OR you can match your positioned patient to the pre-op CT scan. This helps with workflow and reduces fluoro exposure in the OR. Alternatively, if you do not have a preop CT completed per protocol, with our robot system we can still use the intra-op fluoro, intra-op CT, or intra-op simulated CT.

OTW: These are not cheap systems and maintaining them every year is costly. How did you introduce it to your institution? Were you the champion?

Dr. Goldstein: The members of our spine surgery group were all the champions. There was broad leadership support including our division chief Dr. Thomas Errico and administration including SVP David Dibner. As for the university, when they see an opportunity to improve patient care they'll work very closely with us to achieve that.

OTW: What types of spine surgeries lend themselves to robotics?

Dr. Goldstein: I think the sweet spot for the robot is 1 to 3 level minimally invasive spine fusions. And if you're looking to supplement an interbody fusion, whether it be a TLIF, XLIF, OLIF, ALIF, any one of those LIFs.

OTW: Deformity?

Dr. Goldstein: If your practice is minimally invasive, deformity with percutaneous screws and I think robots fit right in there.

OTW: How do robots improve your precision? You've been doing complex spine surgeries for many years, you teach and do



original research. How do these new systems improve your work?

Dr. Goldstein: I think it maintains my precision but with significantly less radiation exposure. And, since it's image guided, I can watch the screw being placed through the monitor and see that screw is going along the path I designed. I am more confident it is in the pedicle.

OTW: How much set up fiddle factor is involved?

Dr. Goldstein: Much less than you think. There is a learning curve and there's a workflow. The workflow with the robot is not bad now and will only get better. I'm very impressed so far.



OTW: Do your marketing folks here at NYU get excited about robots in surgery?

Dr. Goldstein: I think they're excited about it and we'll develop a marketing program. Back in October I remember being in a meeting and having a patient call me while I was at the meeting and asking me if I was going to be using a navigation for his surgery. Patients will seek this out. Patients want the opportunity for the best outcomes. They know what's new.

OTW: Now that you've used robots, where do they go from here 5 years or 10 years from now?

Dr. Goldstein: Certainly, we need to develop user groups because there's an opportunity to expand this. Where will it go? Add-ons—voice recognition, for example.

OTW: Like Alexa? Is that the kind of thing you would want?

Dr. Goldstein: Yeah! I think it's important to remember, however, that this is robot-assisted surgery. The robot doesn't touch the patient. And it's important for people to understand that this is really setting up the surgeon to put the screw in the best place. And it's where the software is very exquisite.

OTW: Does a robot free you up to do some other things or to think in more challenging ways about these cases?



Dr. Goldstein: That's really a two-part question because the burden it takes off my shoulder is really a cognitive burden. I tell my fellows, there's a sequence of how you learn to get to robotic surgery. If you start with robotic surgery, you're never going to learn how to do open surgery. You need to go in sequence. You need to be facile at open surgery. Then you need to be good at minimally invasive surgery and fluoroscopically guided surgery. Only after that natural progression are you ready for robotic assist surgery. If you do it backwards, you're cutting corners and you're never going to get it right. So, you need to go in that order.

Dr. Goldstein: I think that where we'll go next with robotic surgery is revision surgery and complex deformity cases.

OTW: Plus, it's so precise.

Dr. Goldstein: This allows you do it through smaller incisions with greater precision. I had a good level of confidence using fluoroscopy in minimally invasive surgery. With robotic assistance I have a higher level of confidence. And it's faster.

OTW: Thank you so much **Dr. Goldstein.** This was fascinating.

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