



Primum non nocere: robots and spinal surgery

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Provenance: This is an invited Editorial commissioned by the Section Editor Guoxin Fan, MD (Department of Orthopedic Surgery, Shanghai Tenth People's Hospital, Tongji University School of Medicine, Shanghai, China).

Comment on: Lieber AM, Kirchner GJ, Kerbel YE, *et al.* Robotic-assisted pedicle screw placement fails to reduce overall postoperative complications in fusion surgery. *Spine J* 2018. [Epub ahead of print].

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In this article, Lieber *et al.* performed a retrospective analysis of data in the Nationwide Inpatient Sample database, comparing 257 patients who underwent robot-assisted lumbar fusion with 257 matched controls who underwent conventional lumbar fusion. After controlling for various patient factors, they did not find a significant difference in minor or major complications between the two groups. However, they report increased hospital costs and length of stay in the robot-assisted group, compared with the conventional lumbar fusion group.

It is important to keep in mind that these data were obtained from 2010 to 2014. At the time, there was only one FDA-approved, commercially available robot in the U.S. for spinal surgery (RenaissanceTM, Medtronic, Minneapolis, Minnesota, USA). As a result, this study does not reflect recent innovations and techniques available with spinal surgery robots currently on the market, including the ExcelsiusGPSTM (Globus Medical, Audubon, Pennsylvania, USA) the Mazor XTM (Mazor Robotics, Caesarea, Israel) and the RosaTM (Zimmer Biomet, Warsaw, Indiana, USA).

In addition, due to inherent limitations of database queries, the authors are only able to look at certain major and minor complications coded in the Nationwide Inpatient Sample database. They are unable to look at important spine-specific metrics, such as operation duration, estimated blood loss, pedicle screw accuracy, return to the operating suite, radiographic results, and patient-reported

functional outcomes. They also do not have access to long-term follow-up data, so they are unable to assess adjacent segment disease, pseudarthrosis rates, proximal junctional failure and other factors, which limit their ability to truly assess differences between robot-assisted and conventional lumbar fusion cases.

Nevertheless, this study represents one of the first steps in evaluating robotics in spinal surgery. Medicine is based on the tenet of *Primum non nocere*—first, do no harm. Before new technologies are widely adopted, we must demonstrate that they are just as safe as accepted techniques. Such non-inferiority studies are common in healthcare and often pave the way for future studies to determine the exact benefits of new technologies.

Several large meta-analyses show incremental benefits in pedicle screw accuracy, as we move from fluoroscopic to 3D navigation and robotic guidance in lumbar fusion surgery (1). There are additional potential benefits of robotic technology, including the ability to perform more minimally invasive surgeries, to insert larger screws, and to place screws with more favorable biomechanical trajectories—all of which may lead to decreased blood loss, shorter operating time, and better functional outcomes. Like our colleagues who have found increasing benefits with the use of robotics in knee arthroplasty surgery (2), we are likely to find a growing role for robot-assisted spinal surgery.

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Footnote

Conflicts of Interest: Dr. Theodore is an inventor of the Excelsius GPSTM robot described in this commentary. He is entitled to royalty payments on sales of the robot and is also a paid consultant to Globus Medical and owns Globus Medical stock. The other author has no conflicts of interest to declare.

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