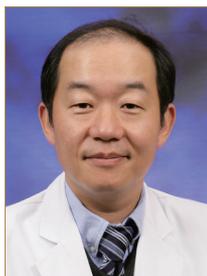




Editorial

Robot-Assisted Spine Surgery: A Solution for Aging Spine Surgeons



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Neurosurgery Society

The introduction of robot-assisted surgery is one of the greatest breakthroughs to have taken place in surgery, and it certainly represents the most significant advancement in minimally invasive surgery this decade. Robots were first used in gynecology, general surgery, and urological surgery, but the robotic revolution is now also occurring in neurosurgery and orthopedic surgery, where robot-assisted surgery is expected to play a crucial role in reproducibly performing procedures requiring very fine manipulations.

Over the past 10 years, spine surgery has adopted robotic technology to develop a new surgical paradigm. However, robot-assisted spine surgery is still in its early stage, and it is sometimes considered as a high-cost surgical tool and as a profitable business model for private spine centers.

This issue of *Neurospine* publishes the results of a cost-effectiveness study on robot-assisted spine surgery. Dr. Menger et al. [1] reported that the application of robotic surgery could be a cost-effective emerging technology resulting in less revision surgery, decreased infection rates, a reduced length of hospital stay, and shortened operative time. Modeling at a major academic center resulted in an estimated \$608,546 of savings in 1 academic year. The editors of *Neurospine* have selected this article as a featured article because it adds more evidence to the ongoing debate about the value of robot-assisted spine surgery.

Although robot-assisted spine surgery has not achieved the highest level of evidence in medical practice, we believe that this is a matter of time, and not a matter of pursuing the wrong direction.

The emergence of an aging society changes the patient population and patterns of disease, as well as the healthcare system. As we have more aged patients, we also have more aged surgeons and healthcare providers. Therefore, the need for high-quality robot-assisted surgical procedures can be seen as a direct consequence of the increasing proportion of aged surgeons. Surgeons make the highest-quality surgical decisions based on lifelong experience and knowledge combined with high-performance robotics that compensate for age-induced reductions in physical competence.

With the goal of achieving the highest-quality robotic technologies for the spine, the editors of *Neurospine* present several technological requirements of which surgical robot engineers and companies should be aware.

The first requirement is high-resolution visualization and real-time navigation technology. Real-time intraoperative high-resolution imaging with navigation will be mandatory to perform safe and reproducible surgical procedures while avoiding excessive tissue damage. Three-dimensional augmented virtual reality imaging technology will be required for visual enhancement. High-speed software and computer systems to autocorrect motions or vibrations, such as movements of the patient or of the surgeon's hand, provide greater safety

and allow surgeons to operate more competently.

The second requirement is the application of machine learning and artificial intelligence (AI). Machine learning and AI could provide appropriate surgical options to surgeons who encounter challenging situations, such as surgical bleeding, neural injury, or pedicle breakage. A computer mentoring or information feedback system could be an ideal solution to fulfill this requirement.

With the development of cutting-edge technology in computer science and robotics, we as spine surgeons have the opportunity to provide even safer and higher-quality spine care to

our patients. Furthermore, surgeons over 70 years old could be able to practice spine surgery with the same level of physical and cognitive performance as surgeons in their mid-40s.

REFERENCE

1. Menger RP, Savardekar AR, Farokhi F, Sin A. A cost-effectiveness analysis of the integration of robotic spine technology in spine surgery. *Neurospine* 2018 August 29 [Epub]. <https://doi.org/10.14245/ns.1836082.041>.