Robot-assisted neurosurgery indications

Robotic-assisted surgery (RS) has progressively emerged as a promising technology in modern thoracolumbar spinal surgery, offering the potential to enhance accuracy and improve clinical outcomes

Robotic pedicle screw placement.

Procedures utilizing robotic assistance during a 24-mo period were retrospectively analyzed and classified as stereotactic or endoscopic based on the mode utilized in the ROSA system (Zimmer Biomet, Warsaw, Indiana) in the Department of Neurosurgery and Craniomaxillofacial Surgery Amrita Institute of Medical Science, Amrita University, Kochi, Kerala, India.

Machine log file data were retrospectively analyzed to compare registration accuracy using 3 different methods: (1) facial laser scanning, (2) bone fiduciary, or (3) skin fiduciary.

Two hundred seven cranial neurosurgical procedures utilizing robotic assistance were performed in a 24-mo period. One hundred forty-five procedures utilizing the stereotactic mode included 33% stereotactic biopsy, 31% Stereo-EEG electrode insertion, 20% cranial navigation, 7% stereotactic catheter placement, 6% craniofacial stereotactic wire placement, 2% deep brain stimulation lead placement, and 1% stereotactic radiofrequency ablation. Sixty-two procedures utilizing the haptic endoscope guidance mode consisted of 48% transnasal endoscopic, 29% ventriculoscopic, and 23% endoport tubular access. Statistically significant differences in registration accuracies were observed with 0.521 ± 0.135 mm (n = 132) for facial laser scanning, 1.026 ± 0.398 mm for bone fiduciary (n = 22), and 1.750 ± 0.967 mm for skin fiduciary (n = 30; ANOVA, P < .001).

The combination of accurate, automated stereotaxy with image and haptic guidance can be applied to a wide range of cranial neurosurgical procedures. The facial laser scanning method offered the best registration accuracy for the ROSA system based on this retrospective analysis [1].

In the case of surgery of the skull base, it has just emerged from an experimental phase.

Neurosurgery is one of the first organ systems in which robotic surgery can play a role, due to the high precision that is required to localize and manipulate within the brain, and the relatively fixed landmarks of the cranial anatomy.

Robotic technology has been incorporated into stereotactic and endoscopic procedures [2,3].

Interest in robotic endoscopic surgery is high because of the small size of the incisions, cosmetic advantages, less invasive surgical techniques, decreased scar tissue, shorter duration of hospitalization and increased cost-effectiveness [4].

Other key neurosurgical applications for robots include robotised microscope [5], telepresence [6], and tumor resection [7].

[1]

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