Intraoperative high-field MR revamps neurosurgery

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Low-field intraoperative scanning has several drawbacks, including a lower spatial resolution that limits the ability to accurately define tumor margins. High-field MRI, on the other hand, allows for image acquisition during surgery with the same quality as diagnostic and postoperative examination and helps control the extent and impact of a resection. It also allows for surgical strategy changes on the go, thus acting as immediate intraoperative quality control, said Dr. Christopher Nimsky, an associate professor of neurosurgery at the University of Erlangen in Germany.

Nimsky and colleagues devised a neurosurgical scheme combining simultaneous microscope-based neuronavigation with a 1.5T MR magnet for intraoperative imaging, which replaced a 0.2T system previously in place at their institution. Unlike standard neuronavigation based on anatomic information, integrated preoperative magnetoencephalography with high-field MR capabilities such as functional imaging can be used to localize and preserve crucial brain areas associated with speech and movement, despite massive resections.

In addition to fMRI, more powerful systems allow for diffusion-tensor and spectroscopic imaging and high-quality angiograms, which prove particularly helpful for surgeons, said Dr. Ferenc A. Jolesz, director of the image-guided therapy program at Brigham and Women's Hospital, which has installed a 3T intraoperative scanner.

"These scanners are bigger, more complex, and expensive to operate. But you get very high quality images to guide surgery," Jolesz said.

Although more studies are needed to justify high-field MR in patients with high-grade tumors, its effectiveness with low-grade gliomas is not in dispute. Intraoperative imaging helps secure a complete resection, reduces complications including intracerebral hemorrhage, and shortens ICU and hospital stays, Jolesz said.

Nimsky and colleagues studied 200 patients with cryptogenic epilepsy and diverse brain tumors, mostly gliomas or pituitary adenomas. The high-field intraoperative MR imaging provided information that helped change some surgical strategies while patients were still on the operating table (Radiology 2004;233:67-78).

Development of intraoperative techniques has brought intervention to a highly sophisticated level requiring interdisciplinary approaches. Partnership efforts between radiologists and neurosurgeons recorded in the clinical literature testify to this trend.

"There are no turf issues at my institution," Jolesz said. "We are planning to make a big operating room, not only for MR, but also for PET/CT, to perform a wide range of oncology procedures and surgeries, not only in neurosurgery."

Disclosures:

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