



Intraoperative MR Suite Elevates Neurosurgical Planning and Precision

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Neurosurgery is a precise, complex procedure that relies on medical imaging for pre-surgical planning to help streamline the procedure and achieve the best possible surgical outcomes. MR provides exquisite soft tissue contrast, multiple contrast mechanisms, and helps clinicians discern neurologic functional anatomy. Collectively, these features provide the critical data surgeons need to optimize neurosurgical plans. However, when preoperative images have been acquired at other institutions or do not reflect the patient's current disease state, their value for pre-surgical planning can be compromised.



For example, a lesion can be obscured by other anatomy or important information obtained from neuroradiology MR sequences, such as diffusion weighted imaging or tractography, may be unavailable. This can lead to a more complicated, lengthy surgery and/or cause the neurosurgeon to change surgical strategy while the patient is in the operating room (OR) under general anesthesia.

Clinicians at Central Military Hospital (Prague, Czech Republic) believe that intra-operative MR imaging (iMRI) may further increase the surgeon's precision and may decrease the patient's risk. In April 2008, the center's neurosurgery and radiology departments installed an intra-operative MR surgical suite with the Signa HDx 3.0T scanner from GE Healthcare.

The MR suite is adjacent to a neurosurgical OR suite, separated by a sliding RF screen room door that enables surgical patient transfer to the MR while preserving the sterile OR environment. Intraoperative MR imaging is achieved through a specialized patient table docking and transport system, which connects the MAQUET surgical table to a specialized Signa MR table. The system maintains consistent patient positioning within the 3.0T compatible MAYFIELD® MR skull clamp between the surgical and MR suites. "By keeping the patient's head fixated within the skull clamp, we can image the patient and accurately upload the data to our neurosurgical system, as well as quickly fuse the intra-operative with the pre-operative images," says David Netuka, MD, neurosurgeon, First Faculty of Medicine, Charles University and Central Military Hospital. "We can then use the intra-operative images without any re-registration, which I find extremely important."

Radiology and neurosurgery work in tandem

As with most healthcare facilities, high equipment utilization is the cornerstone of sound fiscal and capital equipment planning. Since the intra-operative MR imaging volume would typically not exceed more than two procedures each day, Central Military Hospital's neurosurgery department joined forces with radiology to economically justify the 3.0T MR purchase. Patients benefit two-fold: Neurosurgery patients gain from high resolution pre-operative, intra-operative, and post-operative MR imaging, a technology the department could not justify based on volume; and, all patients who require a diagnostic imaging study now have access to one of the most advanced 3.0T MR scanners. The result is improved patient care for both specialties.

A true multi-disciplinary approach that encourages collaboration between radiology and neurosurgery is the key to a successful iMRI program. "It is most important to communicate with neuroradiology, and always involve them in the MR sequence determinations," adds Dr. Netuka. The two teams meet every morning to discuss each case, and the chief of the MR department reviews the pre-operative scan and discusses the appropriate sequences for subsequent intra-operative scans. The goal of this collaboration is to ensure the acquisition of clinically relevant data and maintain an efficient workflow in the iMRI suite.

Neurosurgery schedules its patients with radiology one day prior to surgery, and provides a second notice 30 to 40 minutes before the surgical scan. According to Dr. Netuka, radiology then completes the study that is in process, cleans the MR room, and changes the air to maintain sterility within the





Dr. David Netuka


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About the facility

Central Military Hospital (Prague) installed an MR surgical suite equipped with a Signa HDx 3.0T from GE Healthcare in February 2008. In addition to offering both curative and preventive care, the Neurosurgery Department is an undergraduate and postgraduate teaching facility dedicated to research activities. The facility provides treatment for a wide range of diseases and injuries of the peripheral and central nervous system, including pain management and pharmaceutical epilepsy treatments.

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MR suite. The entire process, from prepping the MR suite to completing the MR exam, is approximately 40 minutes. This efficient process keeps the MR utilization at near-peak capacity – radiology performs 15 to 20 scans daily over an eight-hour timeframe, in addition to the one or two interventional MR scans.

The value of iMRI

Instituting an iMRI program may initially increase surgery time and require a learning curve with changes in workflow, anesthesia, and patient monitoring. However, the surgical confidence in resection volumes and potentially higher quality of care may outweigh these short-term adjustments.

In the first eight months of use, Central Military Hospital performed 142 surgeries utilizing their GE MR surgical suite. Among these were 60 pituitary adenoma and 60 glioma cases. “These are the two most frequent conditions that we treat in the iMRI OR, and it allows us to achieve more radical resections in these cases,” says Dr. Netuka. “Intra-operative imaging also enables us to check the extent of the surgery and the quality of our work. As a result, we are observing fewer repeat surgeries shortly after the initial surgery to remove tumor remnants.”

Dr. Netuka also points out that his team has not observed any increase in complications or infection rates, increasing the department’s confidence that patient safety is fully preserved.

The true value of iMRI lies in the facility’s ability to conduct scans pre-, intra-, and post-operative. When Central Military Hospital relied on externally obtained MR scans for pre-op surgical planning, particularly for glioblastoma surgery, Dr. Netuka discovered that for some patients, the intra-operative finding was slightly different leading to a change in strategy that made the surgery more complicated. “We still do a post-op scan, which allows us to compare all scans and learn from the procedures,” he adds.

Looking forward, Dr. Netuka sees other possibilities for intra-operative scanning with new techniques applied during surgery. “I do believe iMRI will become routine in many tertiary, large-volume hospitals; in fact, I suspect it will become a standard of care for pituitary cases and possibly for gliomas,” he suggests. Dr. Netuka believes other potential investigations of possible indications for iMRI could include: intra-operative tractography; evaluation of extent of resection in intended partial resections; skull base tumors; extent of resection in epilepsy surgery; intra-operative assessment of acute ischemia; biopsies; cystic and multicystic lesions; spinal cord and extradural spinal tumors; and, spine surgery.

“I anticipate that interventional imaging will continue to improve with faster imaging and excellent quality,” says Dr. Netuka. Additional experience, he notes, will further drive success at Central Military Hospital, which can lead to an increase in referrals. “We already see an increase of patients who are directly contacting our institution.”

The bottom line for implementing an iMRI OR suite is the clinical result. Identifying unexpected tumor remnants that can be removed during the initial surgery, and the ability to confirm that no post-operative complications are present, is the most encouraging news that a surgeon can share with patients and their families. ■