FRIENDS OF AMIGO

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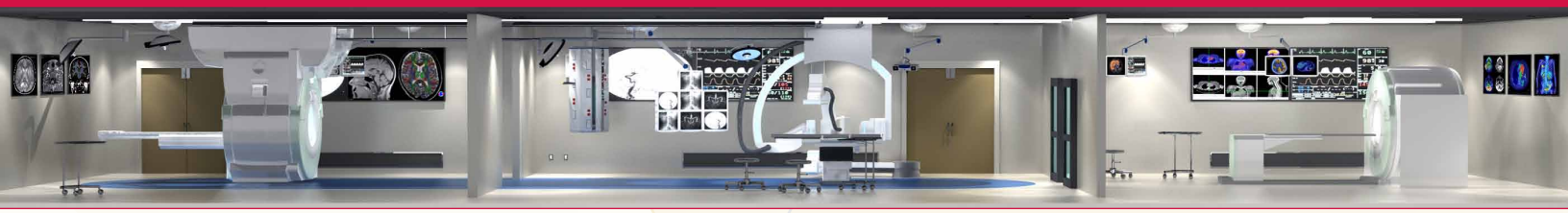
Advanced Multimodality Image Guided Operating Suite

AMIGO is a patient-friendly environment where physicians, engineers, surgeons, radiologists and nurses all work closely together

Teams Make Dreams Happen: AMIGO Suite Nears Completion

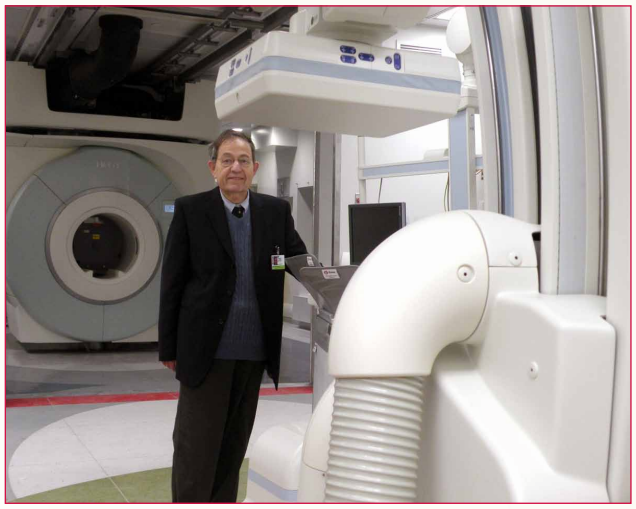


Artist illustration of the Advanced Multimodality Image Guided Operating suite (AMIGO). The PET/CT scanner is to the right, the operating suite is in the center and the movable MR magnet is on the left.

During the past year, beneath the Tower building on L2, a massive project decades in the making has been underway. While pedestrians, cars and shuttle buses streamed up and down bustling Francis Street, underground, specialized construction crews were installing advanced imaging devices, surgical equipment, and building out the support space for a truly unique surgical suite.

On May 4, 2011, Brigham and Women's Hospital (BWH) will unveil the Advanced Multimodality Image Guided Operating (AMIGO) Suite, the first multimodality suite in the world to give surgeons and interventional specialists immediate access to a full array of imaging modalities for use during procedures. This cutting-edge operating room/interventional suite will enable treatments that are less invasive and more effective. Because of this, the opening of the AMIGO suite represents the next major step in Image Guided Therapy (IGT).

Many interventional suites throughout the world use Magnetic Resonance Imaging (MRI) to guide surgical and interventional procedures and drug delivery, a technique that was introduced at BWH. AMIGO will house a high field-strength MRI, Positron Emission Tomography, Computed Tomography (CT), 3D ultrasound, x-ray fluoroscopy and angiography. These devices were all manufactured by Siemens and were integrated by IMRIS, Inc. With this technology and state-of-the-art guidance systems for navigation at their fingertips, AMIGO's surgical teams will advance the use of various imaging methods for guiding, monitoring and controlling numerous therapeutic procedures.



Dr. Ferenc A. Jolesz, in the nearly completed AMIGO suite

A project of this magnitude relied closely on the collaboration of a large team of multi-disciplinary experts. The clinicians, engineers, medical physicists, project managers, architects, contractors and facility supervisors of Brigham's AMIGO project were relentless in creating solutions to the many challenges they faced.

"Building an operating suite of this complexity is unprecedented," says Brendan Whalen, AMIGO project manager from BWH Real Estate and Facilities. "Never before has a project involved so much design planning around surgical suite safety. Because of the radiofrequency energy and magnetic field from the MRI, energy from radioisotopes, the laser, and x-ray equipment, the suite requires extensive lead, steel and copper shielding to protect staff and patients from these emissions."

The overall design of the suite consists of three rooms adjacent to one another: The middle room is a combined operating room and x-ray angiography room where most of the procedures will be performed. Flanking it on one side is the PET/CT scanner and on the other side is the 3T MRI scanner. The three-room layout was intended to make utilization of any of the imaging modalities during procedures as easy as possible.

The decision about the location of the AMIGO suite changed several times. Many factors were considered, such as patient and staff accessibility, surrounding noise and vibration levels and the types of interferences the equipment might experience.

"We tried to build the suite to be future proof," said Dan Kacher, the lead engineer on the AMIGO project. "With insights from our previous intra-operative MRI installations at BWH and from similar sites around the world, we were able to anticipate future needs and accommodate growth and change."

An example of the innovative layout of the AMIGO suite is the design and installation of the MRI scanner. Most MRI scanners are bolted to the floor and remain stationary, a design that requires transporting patients to the scanner for their imaging. For AMIGO, project planners contracted with IMRIS, the company that integrates image guided therapy equipment. They designed and installed a ceiling-mounted system that suspends the 28,000-pound MRI scanner, allowing for it to move into the operating room where it locks in place directly over the patient. This state-of-the-art design removes safety concerns around moving patients from room to room for MR imaging.

Fusion of Prostate MRI and Ultrasound for Biopsy

Hospital leadership has provided key support for the AMIGO project from the earliest planning phases.

"The availability of advanced imaging modalities in AMIGO's highly integrated environment represents an unprecedented opportunity and a one-of-a-kind setting for surgeons, radiologists, cardiologists, radiation oncologists, nurses and technical staff," says BWH President Betsy Nabel, MD. "The investment in AMIGO further reflects BWH's commitment to providing the highest quality health care to patients and their families and to expanding the boundaries of medicine through research."

Become a friend of AMIGO

The Advanced Multimodality Image Guided Operating Project will have a tremendous impact on surgery and interventional radiology, representing the dawn of a less-invasive, more patient-centered era in procedural medicine. Brigham and Women's Hospital seeks the partnership and support of donors who possess the vision and desire to advance the field of Image Guided Therapy. Your assistance will help in training and in the development of new innovative clinical applications. If you would like information on opportunities to support the cutting-edge work of AMIGO, please contact Judi Mullen in the Development office at (617) 424-4351 or jmullen2@partners.org.

Image Guided Therapy at BWH

PET/CT Guided Biopsy

With almost 30 years of innovation to its credit, the Brigham's Image Guided Therapy (IGT) program has played a major role in bringing about a new era in medicine. IGT research at the Brigham has resulted in treatments that have become less invasive, individually tailored to patients, and delivered by teams of clinical specialists and scientists.

The concept of IGT describes any surgical or interventional procedure that uses advanced imaging to localize, target, monitor and control procedures. These types of procedures were first introduced by Ferenc Jolesz, MD, who founded Brigham's IGT program in the early 90s. One of the program's first achievements was to demonstrate that MRI could have therapeutic applications beyond its more traditional use as a diagnostic tool. IGT researchers and their collaborating partners at GE Healthcare built an MR scanner that could support both the surgical and imaging components of IGT procedures that Dr. Jolesz's teams would be performing. The design of this first-of-its-kind MR scanner, dubbed the "double donut," had two circular magnets positioned with an open space for surgeons to access a patient when the patient is lying on the scanner table.

The "double donut" MR magnet enabled medical teams to image patients in real-time, without pausing the procedure to move the patient. For the first time, surgeons were using images taken during the procedure to guide their work. Intraoperative MRI was first used in open brain surgery and has since proven effective for percutaneous interventional procedures like thermal ablations, brachytherapy and treatments ranging from sinus endoscopy to breast surgeries.

The IGT team soon followed the success of intraoperative MRI with another landmark achievement. In 1994, the FDA approved a procedure developed in the IGT program by Dr. Clare Tempany for the first time: MRI-guided focused ultrasound (MRgFUS) treatment of uterine fibroids, a non-invasive procedure that uses MRI to monitor and control high intensity ultrasound waves that, when beamed onto the fibroid, destroy it with intense heat. Doctors could treat uterine fibroids without surgical incision, leaving surrounding healthy tissue intact. Brigham's IGT researchers have since then introduced the technique to treat breast and brain tumors and relieve pain from bone metastasis.

By late 1994, the Brigham had emerged as a leading institution in advancing IGT techniques into widespread clinical practice. Affirmation of this came in 2005 when the National Institutes of Health (NIH) awarded a grant to BWH, naming Dr. Jolesz and his team The National Center for Image Guided Therapy (NCIGT). The substantial funding that came with the grant enabled the Brigham to serve as a national resource and research center for IGT-related translational research (*www.ncigt.org*).

IGT's initial phase was based solely on MR applications. With the grant support, IGT researchers expanded the program to include all other advanced imaging modalities and involve disciplines other than neurosurgery, such as surgical oncology. AMIGO will be the fullest realization thus far of the expanded, multi-disciplinary nature of IGT.

Introducing the Leadership Team for NCIGT

As the NCIGT's clinical and research operations expanded, it became apparent that the program needed dual leadership. The NCIGT and AMIGO are now co-directed by Ferenc A. Jolesz, MD, and Clare M. Tempany, MD. With more than five decades of clinical radiology and imaging research experience combined, Dr. Jolesz and Dr. Tempany are the co-PIs of the NCIGT funded by NIH/NCRR and NIBIB.

Ferenc A. Jolesz, MD

Dr. Jolesz, received his medical degree in 1971 from Semmelweiss Medical School in his native country, Hungary. He completed a Research Fellowship in Biomedical Engineering and a Residency in Neurosurgery before moving to the United States in 1979 to enter a Research Fellowship in Neurology at Massachusetts General Hospital, and later, a Physiology Research Fellowship at Harvard Medical School.

Dr. Jolesz arrived at the Brigham in 1982, where he completed a Residency in Diagnostic Radiology and a Clinical Fellowship in Neuroradiology. In the early 90s, Dr. Jolesz and his research team achieved international acclaim when they introduced intraoperative MRI. He and his colleagues also performed the first MRI-guided laser brain surgery and the first MR-guided focused ultrasound (MRgFUS) procedure. MRgFUS, a non-invasive surgical procedure, has been used to treat benign uterine fibroids and malignant tumors in the brain, breast, prostate and liver.

Currently, Dr. Jolesz serves as the principal investigator for a program project involving the interventional use of MRI and a multidisciplinary program that trains young scientists and physicians in image guided therapy. Dr. Jolesz is a member of the Institute of Medicine of the National Academy of Sciences. He received the Outstanding Researcher Award from the Radiological Society of North America and the Gold Medal of the International Society for Magnetic Resonance in Medicine.

In 2006, BWH established the Ferenc A. Jolesz Chair of Radiology Research to honor his many accomplishments. The first incumbent is Dr. Clare Tempany.

Clare M. Tempany, MD

Dr. Tempany completed her medical degree in 1981 and Internal Medicine residency in her native country, Ireland. She then completed her Diagnostic Radiology Residency at Loyola University of Chicago. She followed that with a Fellowship in Magnetic Resonance Imaging from the Johns Hopkins Medical Institutions, which she completed in 1988. Dr. Tempany arrived at the Brigham in 1991 to become the first Director of Body MRI, later becoming the Clinical Director of MRI. In 2007 she became the Ferenc A. Jolesz Chair of Radiology Research at BWH.

Dr. Tempany has sub-specialty expertise in Pelvic MRI and corresponding research interests in pelvic oncology and prostate cancer imaging and interventions. She currently leads a large prostate research program that includes diagnostic, staging and MRI/Ultrasound guided interventions and treatment guidance programs.

Since 2000, Dr. Tempany has been an investigator participating in multiple trials of MRgFUS devices for MR-guided focused ultrasound surgery. She has completed three trials to test the use of MRgFUS treatment of uterine fibroids and an on-going trial for treatment of metastatic bone tumors.

Dr. Tempany is currently the co-PI for the NCIGT with Dr. Jolesz.

Dr. Ferenc A. Jolesz and Dr. Clare M. Tempany

Come see AMIGO, the crowning achievement of the latest advances in Image Guided Therapy at Brigham and Women's Hospital. Save the date: Wednesday, May 4, 2011. Take an exclusive tour of this cutting-edge operating suite between 1:00 PM - 5:00 PM and help celebrate the grand opening during a reception at 5 PM in the Cabot Atrium Lobby of 45 Francis Street.

To sign up for tours, please email us at *amigo@partners.org*

The First Procedures to be Performed in AMIGO

AMIGO will have a dual function of significantly enhancing clinical patient care while at the same time serving as a clinical translational research platform for validation of novel MRI and molecular biomarkers in order to enhance patient care. It is expected that AMIGO will significantly impact patient outcomes by providing safer and more complete surgical resections.

The first procedures to be performed in the AMIGO suite were selected to demonstrate maximum clinical impact. The list includes established IGT procedures such as open brain surgery, prostate brachytherapy and tumor ablations. The goal behind the selection of this list is to demonstrate how AMIGO will make these procedures more accurate, faster and easier to perform.

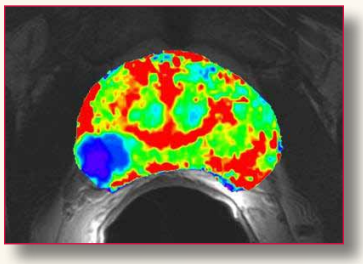
Image-Guided Therapy in Open Brain Surgery

Intraoperative MRI (iMRI) in Open Brain Surgery provides real-time monitoring and visualization of the tumor and surrounding critical brain structures during the operation. As a multimodality suite, AMIGO will allow for further refinements in brain tumor resections. Clinicians will be able to leverage advanced MRI imaging techniques and molecular PET imaging in the intraoperative environment to detect and remove tumors more accurately and completely. This will overcome a major source of treatment failure and recurrence in brain tumors. The use of high field 3T MRI in AMIGO will permit the acquisition and translation of advanced imaging sequences into the operating room previously only available in the diagnostic setting. This allows for enhanced morphological and physiological tissue visualization and differentiation, accurate targeting, and precise real-time monitoring during surgery.

Dr. Alexandra Golby

Radiation Treatment of Prostate Cancer and Gynecological Tumors

AMIGO can provide real time multiparametric MR imaging, ultrasound and PET/CT, advanced image processing, real-time navigation, and visualization tools, which are expected to help overcome some of the current challenges in both prostate and gynecological cancer therapy and diagnosis. AMIGO and NCIGT teams will develop and test methods to improve radiation treatment of prostate cancer, including the use of MR guidance to plan and monitor radiation dose. Other research will seek to improve methods to extract and study the tissue changes seen on MR that are induced by radiation over time. This will allow for the characterization of changes to normal and cancerous tissue using quantitative MR parameters obtained before, during, and after therapy. Correlating these changes with radiation dose and with the resultant clinical outcomes will better quantify biologic effects, and guide more efficacious therapy.



Multiparametric MR for prostate biopsy

These studies will work in parallel with more comprehensive methods, such as robotic-assisted needle guidance and placement and MR-registered US-guided tissue sampling procedures. In the longer term, the goal is to use this approach to enhance focal therapy to provide an image-based lesion/target validation technique for MRgFUS of the prostate. One of the most exciting areas of investigation will involve PET imaging with novel tracers for prostate cancer detection and monitoring of tumor treatments. These approaches can be similarly applied to guide the treatment of women with gynecological cancers.

Breast Conserving Therapy

The goal of Breast Conserving Therapy is to remove the cancer completely, with clear margins around the tumor and cosmetically acceptable results. Currently, the need for repeating the procedure to obtain clear margins is approximately 40 percent in the United States.

Dr. Mehra Golshan

In current breast conserving therapy, there is no acceptable method to evaluate margins during surgery. MRI of the lumpectomy site is currently the most accurate technique for evaluating tumor size and guiding surgery. Using MRI guidance and evaluating margins during surgery is expected to reduce the need for repeat operations. Immediate benefits include more rapid initiation of follow-on therapies, lower infection rates, and reduced cosmetic scarring. The long-term goal is to demonstrate that this approach provides better outcomes than the current therapies for breast cancer treatment.

In the AMIGO suite, an additional breast 3T MRI scan near the end of the procedure will be performed to identify any other tissue that should be removed before concluding the procedure. Initial tests will be conducted with consecutive breast cancer patients who require surgical therapy; the results from 30 patients treated in AMIGO will be compared with those from 30 patients treated conventionally.

Evaluation of Suspicious Lesions in the Pancreas

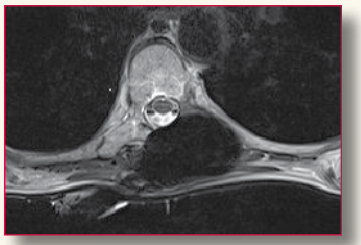
Suspicious Lesions in the Pancreas are often found using CT or MR imaging. The type of lesion may then be characterized using ultrasound imaging. To do this, a device is inserted in the mouth and moved into the stomach. A needle probe guided by ultrasound imaging is passed through the stomach wall into the lesion to collect samples that are analyzed to determine the origin and possible malignancy of the lesion.

In AMIGO, Brigham researchers will also investigate ways to improve techniques for sampling smaller lesions more accurately. One technique that will be studied is the use of pre-procedure 3D MRI or CT-based models and electromagnetic tracking of the ultrasound probe to place it in anatomic context and assist the physician in targeting the lesion. The smaller the lesion that can be biopsied, the more likely partial surgical treatment or image-guided focused therapies and interventions can be used if the lesion tests positive.

MRI Guided Cryoablation

Image guided procedures performed using needle-like devices have evolved rapidly. Cancers in the kidney, liver, lung, bone, and soft tissues can now be treated using ultrasound or CT guidance. However, the main limitation is that the effects of treatment can be difficult or impossible to visualize directly during the procedure. This may adversely impact treatment success or risk injury to adjacent structures. MRI is one of the best ways to show ablation affect, particularly during freezing treatment (cryoablation). The limitations to this use of MRI have been the lack of advanced tools to instantaneously analyze the imaging information and the need to move the patient in and out of the MRI scanner repeatedly.

The AMIGO suite will make new approaches to performing MRI-guided cryoablations possible because, for the first time, patients with attached hardware will remain stationary while the MRI scanner moves to the patient. More importantly, AMIGO researchers will be developing advanced cryoablation monitoring software to instantaneously calculate and visually display the cryoablation information during the procedure. This is anticipated to improve effectiveness of cancer treatment and reduce risk of injury to nearby tissue and organ structures. We will be able to apply these monitoring capabilities during MRI-guided cryoablation of patients with cancer and compare the results to a group of patients who received similar treatment before the use of the software.



Cryoablation of Spine Tumor

Treatment of Atrial and Ventricular Fibrillation (AF, VF)

AMIGO enables rapid advances in the Ablative Treatment of Atrial and Ventricular Fibrillation. AF is customarily treated by inserting a catheter into the heart and selectively burning portions of heart muscle, leaving only the electrical pathways that generate normal cardiac function. Currently, the procedure is performed with x-ray catheter positioning and electro-anatomic mapping guidance.

AMIGO will combine the planning, guidance, and therapeutic steps in VF and AF treatment into a single efficient procedure. We will use MRI techniques to display the inter-connectivity and thickness of the ablation lesions at several stages during the process. Eliminating the spurious conduction paths which cause AF while preserving normal tissue will improve treatment outcomes. Such precise control may result in the reduction in the area ablated, minimizing losses in cardiac function and possibly reducing complications such as stroke, esophageal fistulas, and pulmonary vein stenosis. These procedures will also reduce the x-ray radiation dose to both the patient and the cardiologist.

Brain Tumor Laser Ablation

More than two decades ago, Dr. Jolesz and his team introduced MRI-guided thermal ablation procedures to treat tumors and lesions. In a classic application of intraoperative MRI, one of the first types of ablative procedures Dr. Jolesz's team performed was MRI-guided laser ablation of brain tumors. Following this, the team performed the world's first MRI-guided open brain surgery. Both procedures are now widely performed at medical centers throughout the world.

MRI-guided laser ablation provides a focal surgical approach for brain tumors that are difficult to treat, including patients who are not candidates for open brain procedures due to age or advanced illness, and patients whose lesions have failed to respond to radiation therapy. MR imaging is used to monitor the deposition of heat, which kills the tumor cells. AMIGO researchers will investigate ways to improve the procedure by using faster and more accurate thermal imaging and by using the AMIGO PET/CT scanner to directly verify tissue death after treatment.