Functional MRI in Neuroradiology

The Division of Neuroradiology strives to be at the forefront of the application of new techniques to clinical practice. Advances in MRI scanner hardware, coil technology, pulse sequences, and post-processing software have allowed a multitude of new techniques to enter daily workflow, improving the care of patients across the Emory enterprise. The most exciting developments have been the ability to probe various brain functions including blood flow, water diffusion, metabolite composition, and task related activation.

Functional MRI (fMRI) is a technique that relies on the coupling of blood flow to neuronal activation. As the hemoglobin in blood travels through the brain’s capillaries and the brain extracts oxygen, oxyhemoglobin (non-magnetic) becomes deoxyhemoglobin (magnetic). If an area of the brain is being used more, the body actually overshoots the delivery of blood to the area, so the amount of deoxyhemoglobin decreases. On the particular sequence used for fMRI, that decrease in deoxyhemoglobin results in an increase in signal. By comparing the amount of signal during a task (such as finger tapping) to that at rest (no finger tapping), we can generate statistical maps of where in the brain a particular task causes activation. Multiple blocks of alternating rest and activity are used to obtain enough data to make a reliable comparison.

The types of task paradigms studied vary from fairly standard to those that have been specifically developed in the division for particular indications. Patients are trained by a Neuroradiologist on how to perform the paradigms in advance of the examination. The patient is positioned in the MRI scanner with an angled mirror in front of them that reflects images from a monitor in the room. Images for the paradigm are sent to the monitor in sync with the start of scanning. Upon scan completion, FDA-approved post-processing software and a streamlined workflow facilitates the display of the processed fMRI activation maps on the PACS within minutes to hours from scan acquisition.

fMRI is used clinically for pre-surgical mapping of motor, sensory, and language areas, and is particularly useful in the setting of brain tumors where

- Story continued on page 5
Dear Colleagues,

On December 7th and 8th, 2012, “Use and Abuse of Neuroimaging in the Courtroom: A Multidisciplinary Consensus Conference on Ethical Issues in Neuroimaging” was held in Atlanta, Georgia. Through the support of the American Society of Neuroradiology, the Atlanta Clinical and Translational Science Institute, Emory’s renowned Center for Ethics, and the Emory Neuroscience Initiative, this forum brought together a multi-disciplinary group of experts to evaluate the complex issues involved in the growing use of neuroimaging in criminal and civil trials. Neuroradiologists, neurologists, forensic psychiatrists, neuropsychologists, neuroscientists, legal scholars, imaging statisticians, judges, practicing attorneys, and neuroethicists from as far as the United Kingdom weighed in on an initiative to develop guidelines for ethical use of neuroimaging data in courts.

As reinforced by the cover article for this Rad Report, brain imaging techniques have rapidly evolved over the past three decades to offer exquisite anatomical detail, and increasingly, a variety of functional imaging methods. While excellent for diagnosing neurological disease, current neuroimaging technologies have a limited role in the clinical setting of behavioral matters or psychiatric disease. Yet neuroimaging appears commonly in the courts in criminal hearings. The courtroom is one of many corners of society where radiological imaging is playing a central role in a current debate.

Another such arena is football. The debate about the potential devastating effects of chronic head trauma among football players was further ignited this past year by the suicide of Junior Seau, whose autopsy has subsequently confirmed traumatic brain injuries. The big question is when has a player experienced an injury for which they should be held back from returning to the field. Promising studies involving diffusion tensor imaging (DTI) are detecting signs of mild head injury that may be game-changing.

More and more, the public is aware of the power of imaging. This awareness confers an enhanced understanding of the value of radiological examinations in our communities. Srini Tridandapani’s project that uses a means to associate a patient’s face with his/her radiological imaging to avoid misidentification is also a way for us to connect more directly. The power of our field is enormous; particularly in light of the innovation you promote every day.

Best to all,
Carolyn C. Melzter, MD, FACS
Chair of Radiology and Imaging Sciences

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Message from the Vice Chair for Research

What else could it be?

In the 1950’s it occurred to Denham Harman ‘out of the blue’ (he recalled in a 2003 interview) that oxygen free radicals are the cause of aging. He knew that radiation toxicity is in part due to free radicals. He also knew that radiation causes mutation, cancer and aging. Harman put this together and argued that oxygen free radicals accumulate cellular and organ damage leading to organ loss and eventually death. What else could it be?

By the late 1960’s antioxidant enzymes naturally occurring in the body were discovered. It was speculated that the body evolved to create this enzyme to counter free radical accumulation. After this, the free radical theory of aging became dogma. It appeared in every medical textbook. It led to such acclaim for Dr. Harman that he was nominated for the Nobel Prize 6 times (he never won).

Has the following scenario ever happened to you? You ask someone to explain something; they give an answer you find dubious; they respond with, ‘well, what else could it be?’ If you can’t think of another explanation they consider their point proven. Radio personalities (of both parties) invoke this logic all the time to ‘prove’ their political point of view.

Avid readers of this column may recall that I wrote about the difference between a correlation and cause and effect in the December 2011 issue. I stressed that the only way to demonstrate cause and effect was with a prospective experiment where the treatment (free radicals) is randomly assigned and the dependent variable (aging) was independently evaluated. I hope you recognized that this column started with a correlation and was bolstered with a speculation that logically fit. As Paul Harvey said, here’s the rest of the story.

Dr. Hekimi performed the prospective study. He used 5 groups of worms: group 1 was bred to over produce a free radical, group 2 had excess free radicals caused by exposure to low levels of a known toxin, groups 3 and 4 are the same as 1 and 2 except they were treated with the antioxidant vitamin C. group 5 were normal controls. The experiment compared the lifespan of these groups with the hypothesis that worms with excess free radicals would die young. He published in a 2010 PLOS Biology paper that the genetically altered worms lived 32% longer, the toxin group lived 58% longer, and treatment with vitamin C prevented these increases in lifespan! In a 2012 follow-up study, he genetically modified worms to eliminate the natural production of antioxidant enzymes. This had no effect on lifespan.

I am in no way criticizing Dr. Harman for his insight and its publication. Science needs creative people to put forth hypotheses to test. The problem here was the leap to cause and effect. Be wary of the ‘what else could it be’ justification for anything. Because you can’t come up with another explanation doesn’t make the current explanation true.

Oh, are you going to keep taking excess vitamins?

- John Votaw, PhD
Vice Chair for Research
AWARDS & RECOGNITION

Adam Brown, B.S., RT(N)
Radiology and Imaging Sciences

PET Specialty Examinations
Adam Brown recently passed the PET Exam. The PET Exam is administered by the Nuclear Medicine Technology Certification Board (NMTCB) as a specialty examination designed to allow the PET technologist the opportunity to demonstrate his or her expertise in the field of positron emission tomography and properly use the credentials “PET.”

Kord S. Nicholls
Radiology and Imaging Sciences
Bachelors Degree Health Care Management

Kord recently received his BA degree in Healthcare Management from Westwood College. He began his career with Food Services at Emory University Hospital in 2007. Kord is currently a Radiology Transporter for the Department of Radiology and Imaging Sciences.

Merrill’s Award

We are pleased to announce the Merrill’s Award for December is presented to Donna Allender! Donna is a multi-modality technologist at Wesley Woods, specializing in x-ray, CT and IR. She earned the award based on the submission of a portable Kidney-Ureter-Bladder (KUB) obtained under very difficult conditions. Please congratulate Donna when you see her around!

Remember: you can’t be the next Merrill’s winner without submitting an image. The committee would love to see more participation from across our Emory campuses. We know those awesome images are out there! Be sure to recognize your own or others’ stellar work by submitting a nomination for the Merrill’s Award. Blue Merrill’s Committee folders are located in each diagnostic work area.

NEW GRANTS

Tagging Medical Data Streams with Patient Photographs to Decrease Patient Misidentification Errors

Principal Investigator: Srini Tridandapani, PhD, MD
Co-Investigator: James Provenzale, MD, Kimberly Applegate, MD, MS, P. Bhatti, PhD

Funding Organization: Emory/Georgia Tech Healthcare Innovation Program (HIP) and the Atlanta Clinical and Translational Science Institute (ACTSI)

Significance: The objective of the proposed work is to implement and test a novel technique of incorporating point-of-care digital photography with medical imaging studies to decrease patient misidentification errors and improve radiologists’ efficiency. Misidentification errors in medical imaging can lead to serious consequences. Despite use of the Joint Commission’s dual identifier method before delivery of any healthcare, misidentification errors persist; these errors are particularly troublesome in patients, such as unconscious trauma victims, who cannot communicate identification information.

RADIOLoGY RESEARCH SPOTLIGHT

10th Annual Division Student Research Symposium

J. Scott Cordova, an MD, PhD student in Dr. Shim’s laboratory competed at the GDBBS (Graduate Division of Biological and Biomedical Sciences) 10th Annual DSAC (Division Student Advisory Committee) Student Research Symposium on Friday January 11, 2013. There were 70 graduate students from various research labs at Emory competing at this research poster competition. Scott won the first place. The title of his research poster was “Volumetric evaluation of tumor resection using tumor-targeting dye, 5-aminolevulinic acid (ALA), in patient with glioblastoma.” Other co-authors were Scott Hwang, Chad Holder and Constantinos Hadjipanayis.

Abstract - Current post-resection evaluation of glioblastoma multiforme (GBM) relies on the product of the two largest orthogonal tumor diameters on contrast-enhanced T1-weighted MRI scans. However, the limitations of this method have been reviewed in detail and include: a difficulty measuring irregularly shaped tumors, a lack of assessment of the non-enhancing tumor, and an inaccurate assessment of blood product infiltration into the resection cavity postoperatively. The current work aims to standardize a signal-based contouring approach for tumor segmentation using an FDA-cleared imaging platform to produce reliable and consistent tumor volumes.

- Hyunsuk Shim, PhD
Associate Professor of Radiology and Imaging Sciences
This issue marks the sixth year anniversary of the Rad Report. Over the last year, many faculty and staff members have been featured in the Rad Report. Test your Rad Report knowledge to win a prize by completing the Match-Me quiz using previous Rad Reports from February 2012- January 2013 (See prize details on page 1). Match the statement with the picture. Submit your completed quiz only by email to cdingle@emory.edu (with Match-Me Quiz in the subject). The answers will be posted on the website on Friday, Feb. 22.
the normal anatomy may distorted from mass effect making it impossible to tell where critical regions are in relation to the tumor. By preoperatively mapping the areas of task driven activation, the technique allows selection of an optimal surgical strategy and approach. In some cases the preoperative fMRI has changed the decision from performing only a biopsy to attempting a total resection, and in others determined that the safest intervention would be only a biopsy due to close proximity of critical language or motor areas. The surgical approach including direction in which the resection is performed can also be impacted by where the fMRI determines the critical area to be relative to the tumor. These same applications are used for vascular malformations in the brain such as cavernous malformations and arteriovenous malformations (AVMs). For AVMs, where other options including stereotactic radiosurgery are available, fMRI can help assess the safety of performing surgery and the relative risks compared to the other treatments.

A newer application of fMRI used by the Neuroradiology division is the pre-surgical lateralization of language and memory for patients undergoing epilepsy surgery. Patients who will potentially have a portion of their temporal lobe removed in an effort to control or potentially cure their seizures undergo extensive workup including Neuropsychological testing to determine the risk of language or memory problems after surgery. fMRI can help lateralize language and memory function to the right or left hemisphere, so that the risk in a particular patient can be assessed and the decision for further invasive testing and surgery can be made. Continued improvements in acquisition strategies and the development of newer paradigms will undoubtedly expand the utility of fMRI for the assessment of a variety of disorders affecting the brain, and will become part of the clinical care of more of our patients at Emory.

- Admit Saindane, MD
Director of Neuroradiology
**Quality Corner**

**What Does the American College of Radiology Do For You?**

Established in 1923, the ACR is the primary voice for the radiology community on socioeconomic and professional practice issues. Today, the ACR has a multifaceted agenda embracing the economics of radiology practice, quality of care, education and research. There are currently 423 staff and a talented group of over 1,000 volunteers to achieve its goals.

The governance structure of the College is complex: there is a Board of Chancellors (BOC) made up of chairs of both the operational and subspecialty commissions that implements policy and it is led by the BOC Chair and Vice Chair—both Drs. Carolyn Meltzer and Kimberly Applegate are BOC members. There is a Council Steering Committee (CSC), led by the Speaker and Vice Speaker (Kimberly), which runs the annual meeting and creates policy. The Council meets once per year to debate policy and guidelines and it follows a uniquely democratic process. This Council is a representative body comprised of one councilor and one alternate councilor per one hundred members of the state chapters. There are also councilors representing the specialty and subspecialty societies, the military branches, and Canada.

There are many programs, educational products, and policies that the ACR provides to its members. Some are little known to members, and include monitoring and negotiation of policy with federal, regulatory, and payer organizations. For example, during the recent 'fiscal cliff' session of Congress, the College was actively participating in discussions with the Congress about the Sustainable Growth Rate (SGR) Fix to minimize cuts to medical imaging reimbursement.

Last fall, the College established the Neiman Health Policy Institute (HPI) to study the value and role of radiology and radiologists, in anticipation of the HC environment change from FFS to the ACO. The HPI has created a policy brief series and a call for proposals -- released December 2012--for seed grants for junior researchers.

- Kimberly Applegate
  *Director of Practice and Quality Improvement*

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**Check It Out**


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**HR Tip**

**Onsite Health Screenings**

Emory values the health and well-being of our faculty and staff and we encourage our employees to take care of their overall health and wellness.

We are providing opportunities for our faculty and staff to participate in a health screening and complete an online health assessment to earn a financial incentive on their Emory medical plan. The screening and online assessment are available to all benefits-eligible employees, but only those who participate in Emory's medical plan will receive the financial incentive.

Emory is offering free, onsite employee health screenings, through late February, at over 50 locations across campus. Please for additional information visit www.hr.emory.edu/eu/screenings.

- Pamela Wimberly
  *HR Manager*
Reading Room Coordinators – A Team Approach

The Department of Radiology and Imaging Sciences has made extraordinary strides in the past year. One of the areas where we have excelled is our growing commitment to teamwork. Every person in our department plays an integral part in creating a culture of service excellence. By working together, we have the ability to achieve higher goals. There is one particular group of individuals we would like to recognize. This is the Reading Room Coordinators (RRC).

Our department has 11 subspecialty reading rooms. Reading rooms are areas where images are digitally viewed and interpreted by Radiologists. To fully optimize our services to patients, families and referring physicians, we have a designated coordinator in each reading room. They assist the Radiologists, Residents and Fellows with day to day operational workflow and any issues that may arise. Some of their main areas of focus include:

- Managing calls to the Reading Room from non-Radiology providers and clinicians
- Facilitating resolution on hardware related issues
- Communicating and acting as liaisons between the Radiologists and Technologists
- Relaying critical patient information from the interpreting Radiologist to referring providers
- Ensuring reports are available in a timely fashion
- Uploading outside images for consultations
- Calling patients to inform them of upcoming procedures

The above duties allow our physicians to provide results to our patients and patients’ families in a timely manner. With the assistance of the RRCs, our department has consistently exceeded our 85% target of report turnarounds within 24 hours! They have proven that more can be accomplished when we work as a team. Great job to all of our RRCs:

Abdominal: Michael Buadoo
Cardiothoracic: Dexter Bostic
Interventional: Lynn Coram-Allen
Neuro: Sarah Zingarelli
Musculoskeletal: Wangail Assamenew (Backup: Brenda Stokes)
Nuclear Medicine: Inez Dupree
Midtown Reading Room: Judy Graham / Rick Foster
Emergency Radiology: Stacey Walker / Lennex Annor
EUH Mamm: Lisa Kappel (Backup: Brenda Stokes)
EUHM Mamm: Roslyn Baitey (Backup: Barbara Walton)
EJCH: Dyeisha Lenoir (Backup: Chris Johnson)

-Willie Arnold
Senior Manager, Clinic Operations

NEW FACES & APPOINTMENTS

Ashlyn Bierman
Radiologic Technologist- EUOSH

Prior to joining the Department of Radiology and Imaging Sciences, Ashlyn earned her Bachelor’s Degree in Medical Imaging from Emory University. As a student she was the Vice President of the Emory Lambda Nu Honor Society. Her area of focus is medical imaging with advanced training in Interventional Radiology.
NEW FACES & APPOINTMENTS

Tina Dawson
Administrative Coordinator
Tina has been with Emory Radiology for five years. Prior to working for Cardiothoracic Imaging, Tina was the Administrative Coordinator for Billing and Coding at Decatur Plaza. She has over 15 years of administrative experience and is on track to graduate this Fall with a Bachelors Degree in Business Management from the University of Phoenix.

Carolynn Pollock
Radiologic Technologist – EUOSH
Carolynn earned her Bachelor’s Degree in Medical Imaging through the Medical Imaging Program at Emory University. She graduated with honors and was a member of the LAMDANU honors society. Her area of focus is in X-ray and MRI.

Jiyoung Mun, PhD
Assistant Professor
Dr. Mun was recently promoted to Assistant Professor in the Department of Radiology and Imaging Sciences. She has been with Emory for eight years and specializes in radiochemistry (carbon-11, fluorine-18) for positron emission tomography (PET), and synthetic organic chemistry for drug development. Her research focus is to develop tracers for PET to probe physiological changes. Dr. Mun completed her postdoctoral training in the Radiopharmaceutical Discovery lab in the Department of Radiology and Imaging Sciences. She received her Bachelors of Science degree in chemistry from Korea University and her PhD in Synthetic Organic chemistry from University of Connecticut.

Updates from Imaging Applications Support

Cerner Millennium 2012 Upgrade:
Information Services will upgrade Cerner Millennium to the 2012 code on Saturday, February 2nd at 11:55pm. Millennium i.e. RadNet, PowerChart and CPOE will be down Saturday, February 2nd from 11:55pm until Sunday February 3rd at 4:00am. During this time the downtime procedures will need to be followed.

The RadNet upgrades include:
1. Low Light preference
2. New columns available on the worklist and signout tabs
3. Two additional “Favorite” buttons
4. Search by CMRN (EMPI)
5. MPages

GE Centricity 4.0 upgrade for GE Centricity on the Virtual Desktop (CVDT):
On Tuesday night, January 29th GE Centricity on the VDT will be upgrade from GE 3.2 to GE 4.0. This has been a phased upgrade, and will have no downtime associated with it. The upgrade includes:
1. New skin color (most noticeable change)
2. Icon changes - Close application icon
3. Cancelled exams w/ no images or reports are filtered out of the patient jacket
4. Navigator Tool:
   - Thumbnail Strip
   - Drag and Drop feature

- Wendy Lybrand, Radiology Informatics Trainer

NEED FOR NEWS

Would you like to contribute to the Rad Report?
This February we are celebrating the sixth year of publication for the Rad Report. Our readership has grown with new subscribers each month and currently generates more than 500 hits on our website the day it is released.

The primary goal of our newsletter is to serve as a vehicle for communicate across our divisions and create a better understanding of how each of us contributes to the department as a whole. Through the continuous content submissions, the commitment of the editors, and the dedication of the readers, this newsletter is a success. Thank you to all who, through monthly content submissions, have utilized this tool to disseminate pertinent information and recognize the accomplishments within our department.

Thank you to the editing team for reviewing the content each month before going to print. Editors: Dr. Carolyn Meltzer, Dr. William Torres, Chuck Powell, Dr. John Votaw, Dr. Mark Mullins, Dr. Kimberly Applegate, Dr. Deb Baumgarten, Alaina Shapiro, Jessica Paulishen, Monica Salama and photographs by Kevin Makowski.

Thank you to the readers who make the effort worthwhile. Without your readership, the newsletter would fail to serve its purpose. If you have an idea for a story or would like to acknowledge a professional accomplishment, you can become involved with the Rad Report by sending an e-mail to cdingle@emory.edu. When submitting content for consideration, please copy your supervisor, manager or director.

- Camille Dingle, MBA
Communications Specialist

Look for a new issue of the Rad Report the first full week of March.