Signals

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NEWSLETTER OF THE SECTION FOR MAGNETIC RESONANCE TECHNOLOGISTS

IN THIS ISSUE

President's Letter

Cindy T. Hipps, B.H.S., R.T. (R)(MR)

Where does the time go? This is a question I ask myself daily. As many of you know, after working all day, it is hard to go that extra step and attend an MRI conference, read a professional article, serve on a committee of the SMRT and certainly to be an officer of the SMRT. Well, as an MRI technologist working full time with a family, I have found it very rewarding and self motivating professionally to be involved with the SMRT. Believe it or not, I can find that extra energy because I get so excited about MRI and MRI educational opportunities. The SMRT does have EXCELLENT educational opportunities coming up. We also have an opportunity for YOU to get involved.

The SMRT Program Committee has been diligently preparing for the Annual Meeting. Chaired by **Nanette Keck**, the committee has already confirmed that Drs. Crues and Kressel will be together again. For those of you new to the SMRT or who do not remember, Dr. Crues and Dr. Kressel helped to form the Section for Magnetic Resonance Technologists. The prestigious award given to individuals who make outstanding contributions to MR education is named the Crues-Kressel Award in their honor.

Be sure to check the SMRT Website for updates on the SMRT Annual Meeting and the trip to Miami Beach! I also encourage you to submit an abstract for an oral or poster presentation. Along with the other attendees, I enjoy that portion of the meeting. It is rewarding to see other technologists involved in their profession and making a difference in the healthcare field. Won't you help make a difference by submitting your work and sharing it with your colleagues from around the world?

I have received many comments from MR technologists who are concerned about the ARRT allowing Non-RT's to sit for the advanced MR Registry. The SMRT's mission is to promote quality MR education to all MRI technologists. The ARRT has not made a decision concerning this matter. If you feel strongly about this issue one way or another, I would encourage you to contact the ARRT. The ARRT has been in conversation with the SMRT and we will hopefully have input concerning educational requirements and qualifications of MR technologists. **John Christopher**, SMRT Education Chair, has been working with his committee on the revision of the SMRT Curriculum guidelines. The revised document will be posted on the SMRT Website when it is complete.

It gives me great pleasure to introduce **Julia Lowe** as the new SMRT External Relations Chairperson. This is a three-year commitment, which Julie has accepted to carry on. She has served the SMRT in various capacities over the past several years. During her tenure as SMRT Policy Board Member from 2001-2004, she served as the Education Chair two of those years. The Education Committee is one of the busiest committees within the SMRT. She did an outstanding job promoting quality education at the SMRT meetings. She was effective in implementing the first oral poster presentations at the 2003 Poster

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Walking Tour held at the SMRT Annual Meeting in Toronto. She was instrumental in bringing about the approval of continuing education credit, through the ASRT, for the proffered papers. Julie makes a difference on whatever committee she serves!

Ms. Lowe is currently employed by OrthoIndy, an orthopedic hospital in Indianapolis, Indiana, as an MRI technologist. Julie is motivated and strives to always make a positive impact on whatever she aspires to do! The SMRT is fortunate to have Julie in the capacity of External Relations Chair. I look forward to working with her and her committee. You can view her committee in the committee lists as found in this issue.

Have you heard the latest? The SMRT announces our Fall Regionals! There is an SMRT Regional Educational Seminar coming to your area soon. See pages 10-13 or go to: www.ismrm.org/smrt/regional.htm to view the programs that will be hosted by individuals just like you! Anyone can host a Regional, and the SMRT Policy Board will arrange for you to have a mentor to help guide you with the process. If you feel your area needs more technologist education, contact **James Stuppino**, SMRT Regionals Chair, and let him know you want to bring quality MR technologist education into your area! It is fun to plan these seminars and you will meet a lot of wonderful people along the way.

The SMRT Policy Board is comprised of individuals who were elected by you, the members, to serve. In addition to the Policy Board, the Executive Committee and ex-officio Board members are working diligently on developing a strategic plan to help guide the SMRT for the next five to ten years. These efforts are encouraged by ISMRM, our parent organization, and will be consistent with their guidelines. The SMRT Policy Board is committed to work hard to make sure members' benefits are increased while maintaining the financial stability of the organization. We are trying to put a plan on paper that will help us reach new goals while striving to improve processes that are already in place. Each standing committee and sub-committee has been assigned major objectives in which they are to develop strategies on how to achieve these goals in the next five to ten years. If you have any suggestions or ideas about a certain subject or topic that you would like the SMRT to consider when developing the strategic plan, please contact me and I will forward the information to the correct committee chair.

Anne Sawyer-Glover, Editor of the *SMRT Educational Seminars* home study program has been industriously preparing material for you! She is looking for SMRT members to help write questions for the upcoming home studies. Writing questions for an issue of the home study program is a great learning experience as well as a way to get more involved with the SMRT. When volunteering to write questions, I chose subjects with which I had the least amount of experience so I could learn more about the topic myself. Contact Anne if you are interested in writing and reviewing for the SMRT home studies.

Maureen Ainslie, SMRT Past President and Chair of the Nominations and Awards committees has recruited qualified and motivated individuals to run for Policy Board of the SMRT. In the future you can nominate a colleague or volunteer yourself to run for the five positions. These are three-year commitments, but trust me, it is a rewarding experience!

PLEASE, help us to promote the SMRT by sharing all the benefits of being an SMRT member with your colleagues. I truly believe in the SMRT, and it is essential that we try to involve as many MR technologists as possible. The more members we have, the bigger voice we have when MR issues come up that affect us as technologists. Now more than ever the SMRT has the opportunity and the responsibility to help ensure the educational quality in the field of MRI! I am always available if you would like to offer suggestions on ways to improve the benefits to our members. **Todd Frederick**, SMRT Membership Chair, will also take any ideas you have! This is an organization for all levels of MRI technologists. We can all learn from each other. I encourage you to: ***"Each One, Reach One!"*** ●

Editor's Letter

Julie Strandt-Peay, B.S.M., R.T. (R)(MR)

Greetings.

Your SMRT has been extremely dynamic during this past quarter. President **Cindy Hipps** give us an update and introduces new External Relations Chair, **Julia Lowe**. We welcome her and look forward to news from related health care professional organizations in future issues. **Maureen Ainslie**, Nominating Committee Chair, reminds us that we have a responsibility to help form the future of the SMRT. Educational Seminars Home Study Editor **Anne Sawyer-Glover** introduces the latest offering. Program Chair **Nanette Keck** gives us a progress report of the Annual Meeting plans. A complete listing of the SMRT standing committees including the chairs and members is included for your information. Remember that all of these people are volunteering so that you can benefit from the SMRT activities.

Our feature columns this issue are from **Michael Kean**, who shares his experience in pediatric imaging; **Frank Shellock**, safety expert who cautions us about another device; and **Robin Greene-Avison**, SMRT Past President, who contributes her spectroscopy work from two institutions. For more educational opportunities, see the listing of Regional Seminars provided by Chair **James Stuppino**. If there is not a Regional near you, consider hosting one. You will gain immeasurable experience and be a hero among your peers in the area.

Authors from the Annual Meeting in Kyoto share their award-winning efforts that were presented as papers and posters. SMRT continues to participate in the RSNA meeting as a member of the Associated Sciences. Be sure to watch as details emerge for that important meeting later this year. An interesting book is reviewed for you. See if this is a tool that may help you in your daily practice. As always, you are reminded to check the calendar listings for upcoming events. ●

Your Vote Is Important– Make It Count!

Maureen Ainslie, M.S., R.T. (R)(MR), Past-President and Chair, Nominating Committee

It is that time of year when you have the opportunity to participate in the future of the SMRT. As a voting member you not only have the privilege but the responsibility to vote for the individuals who will lead the SMRT into the future. When your ballot arrives, please take some time to review the merit and experience of the candidates and select those individuals who you think will serve you and the SMRT well. Your selection will help determine the quality of leadership for the SMRT.

You will be asked to select a candidate for President-Elect, five candidates for Policy Board, and a recipient for the Crues-Kressel Award. Please remember the President-Elect and Policy Board positions are a three-year commitment to serve the membership of the SMRT. The volunteers who serve on the Policy Board represent you as they work to provide valuable MR educational opportunities and expand your membership benefits, ever mindful of the costs associated with these benefits. This year the ballot will also ask you to vote on a By-law change for a new SMRT Student Membership category. Ballots will be mailed to you on 15 October 2004. Included with the ballot are brief biographical histories for all the candidates. Please review them and mark your choices. As a reminder, only those voting members in good standing, with annual dues paid, are eligible to vote. Follow the directions carefully to sign and mail your ballot or it may not be counted. The postmark deadline is **1 December 2004.** The ballots will be counted and the results will be announced in an upcoming issue of *Signals*. If you have any questions about the election procedure or your eligibility to vote, please contact me at: maureen.ainslie@duke.edu or SMRT, 2118 Milvia Street, Suite 201, Berkeley, California 94704 USA, Phone: +1 510 841 1899, Fax: +1 510 841 2340. ●

Update on Home Studies: *SMRT Educational Seminars*

Editor, Anne Marie Sawyer-Glover, B.S., R.T. (R)(MR)

Welcome to *"K-Space in the Clinic,"* our twenty-fifth home study issue of the *SMRT Educational Seminars*. Your tour guides, Cynthia B. Paschal, Ph.D., and H. Douglas Morris, Ph.D., will provide some interesting concepts and perspectives with which to apply these principles to everyday clinical MR scanning. Now, more than ever, we need to revisit basic MR fundamentals of image formation. The increasing number of new imaging sequences and acquisition options necessitates our full comprehension in order to fully utilize these enhancements and alleviate any new accompanying artifacts.

We are especially privileged to have Drs. Paschal and Morris share their experience and knowledge with us, the membership of the SMRT. Their straightforward interpretation and presentation of this complex material provides an enjoyable and almost effortless reading experience. The material is especially valuable as it reviews the latest state-of-the-art pulse sequences and innovative methods of traversing k-space.

Many thanks to Andrew Cooper, Todd Frederick, Michael Kean, and Steve Shannon for participating in this home study by writing the questions for the quiz which ultimately results in the generation of continuing education credits. Also, a big thank you to Mike Moseley for reviewing the quiz and to Greg Brown for his support as chair of the SMRT Publications Committee.

The SMRT welcomes and actively seeks out articles written by technologists and radiographers as a contribution to our home studies program. Sharing information with your peers is not only a worthy endeavor, it furthers the technology and results in improved healthcare overall.

Accreditation (U.S.) for all home study issues of the Educational Seminars is maintained annually by the SMRT. Back issues may be obtained from the SMRT/ISMRM office located in Berkeley, California, USA for twenty dollars (USD) each. For a complete list of back issues, please go the SMRT Website: www.ismrm.org/smrt. If you live outside of the U.S. and have interests or questions concerning accreditation within the country where you reside, please contact me at amsg@stanford.edu or +1 650 725 9697.

If you are looking to become more involved in the SMRT, please consider writing questions or an article for one of our home studies. The instructions for writing questions will be posted on the SMRT website in the near future. For additional information, please contact me directly or Jennifer Olson, ISMRM Associate Executive Director, at the office in Berkeley, California, USA (smrt@ismrm.org, +1 510 841 1899).

Finally, I would like to thank Tom Schubert and all of the splendid people at **MRI Devices, Inc.** who support our home studies program, *SMRT Educational Seminars*. Their continuing support of technologist and radiographer education brings knowledge to the SMRT membership worldwide. ●

14th Annual Meeting of the Section for Magnetic Resonance Technologists

Nanette Keck, R.T. (R)(MR), 2005 SMRT Program Committee Chair

The Program Committee for the SMRT Annual Meeting has already been working to provide you with an outstanding MR educational opportunity. This 14th Annual SMRT Meeting will be held 6-8 May 2005 in Miami Beach, Florida, USA. Topics and speakers are selected based on the evaluation forms from the previous meeting and suggestions from SMRT members. By designing the program in this manner the information will be appropriate and timely for all of you who attend. As a SMRT member you are welcome to offer ideas for educational presentations at the annual meeting or at any of the regional educational seminars.

I would like to thank the following SMRT members who have so graciously volunteered their time to serve on the Program Committee this year: Robin Greene-Avison, Nancy Hill-Beluk, Heidi Berns, Silke Bosk, Muriel Cockburn, Randy Earnest, Todd Frederick, Marcia Gervin, Cindy Hipps, Michael Kean, Bobbi Lewis, Jim Stuppino, and Judy Wood. We welcome SMRT members from the Miami area to offer their help as well so that we can optimize our efforts.

The SMRT has again been invited to participate in a joint forum with the ISMRM entitled "Optimizing Sequences and Protocols." Presentations covering Oncology or Cardiac Imaging were most often recommended. Topics being considered for the didactic sessions are: Musculoskeletal, Central Nervous System, Pediatrics, Low field, 3 Tesla, Breast, Artifacts, Diffusion and K-space, Abdomen, Coils, Parallel Imaging, and of course Safety. Arranging these topics and suitable speakers will produce an abundant amount of information packed into the two days allotted. Program updates will be published as details are finalized.

One of the most respected portions of the Annual Meeting is the submission of work by SMRT members in the form of an oral or poster presentation. This aspect of the meeting continues to grow with increasing numbers each year. The educational value of these efforts has been recognized by the awarding of continuing education credits by the ASRT. We hope that you and your peers will consider sharing your work for the advancement of MR throughout the world. The SMRT abstract deadline is **17 January 2005**. Selected papers are presented throughout the meeting with ample time for attendee questions of the presenters.

The Program Committee is planning to continue the Poster Walking tour, which gives the attendees a chance to view the work exhibited and discuss the work in person with the author. Several posters will be selected for presentation to the entire gathering. This special session is held the Friday evening prior to the weekend didactic sessions. Watch for details as they evolve.

We invite you to make your plans now to attend the SMRT Annual Meeting in Miami Beach next May. We look forward to seeing you there!

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MR Imaging of the Developing Brain

Michael Kean, R.T., MRI Unit, Department of Medical Imaging, Royal Children's Hospital, Parkville, Australia

In this issue of *Signals* we are going provide you with a brief insight into MR imaging of the developing brain. The developing brain is a very intriguing subject with a multitude of references available for reflection on this subject.

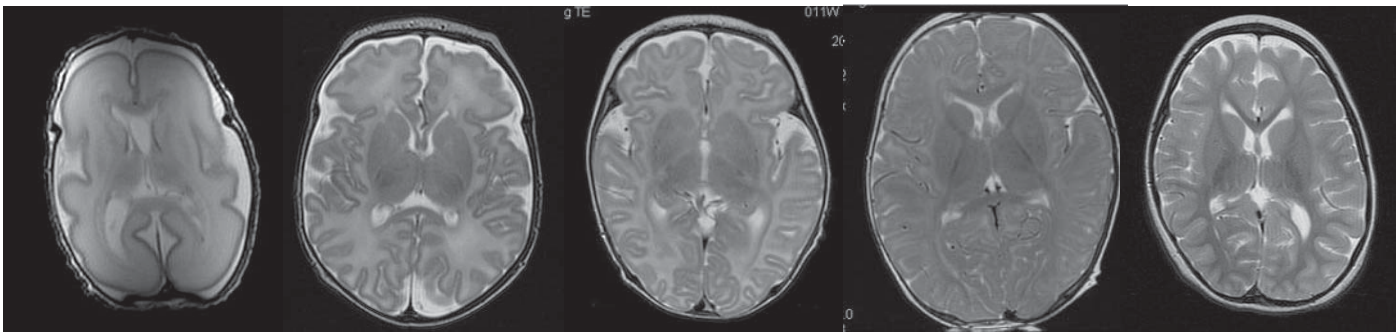
The key factor relating to MR imaging of the developing brain is that in general the myelination of the brain is a predictable and orderly process that observes well-documented rules but as in many areas of MR this may not always be the actual clinical path. Development of these normal processes can be disrupted by genetic factors, infections, metabolic or ischemic pathologies.

1. The primary descriptive feature is that areas of the brain become myelinated at the time they become functional.
2. Central sensory areas will become myelinated before central motor areas.
3. Primary function areas myelinate earlier than associated functional areas.
4. The brain myelinates caudad to cephalad, dorsal to ventral.
5. Signal changes on T1- and T2-weighted MR images will reflect the physiological and biochemical process of myelination.

The change of signal intensities due to T1 and T2 relaxation time shortening reflects the changes in total water content, reduction in the percentage of mobile or free water and the accumulation of cholesterol and glycolipids– essential components in the development of myelin. The total lipid content (Cholesterol, Glycolipids) generally increases in the first 12 months and there is a corresponding decrease in total water content. Immature myelin will have a different appearance on MR imaging than mature myelin. These changes can be accurately demonstrated on standard MR sequences. Myelination can be viewed as a triphasic process where classic appearances on T1 and T2 sequences are evident. During the first 6 months of life delineation of myelinated areas is best demonstrated on T1 or Inversion Recovery sequences. During this period T2-weighted images are often preferred for anatomical evaluation of cortical and sub-cortical areas. The contrast between gray and white matter on T1 imaging at birth is very different from that of the adult brain; white matter is of lower signal intensity than gray matter and as myelination progresses the signal intensities revert to adult signal differences.

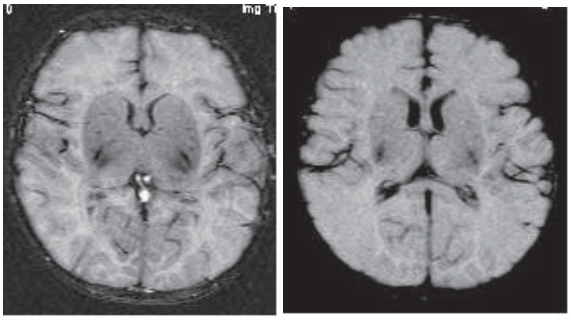
These changes in signal intensity or transition of signal usually occurs between 6-9 months of age. Prior to this transition T2-weighted images play a less significant role in defining the stages of myelination. During the latter stages of

Developmental Stages– Imaging



28 Week (1 Day) | 18 Days | 3 Months | 7 Months | 2 Years

Images: Royal Childrens Hspital



Selective White and Gray Matter Sequences

TR 11,000 TE 25 TI 3400/3700

Images: Westmead Childrens Hspital

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myelination, at 18 months, the brain is considered myelinated in MR terms, the T2 signal changes can provide critical information relating to particular stage of development.

The change of water content and total lipid concentrations will need to be reflected in the MR sequences and parameters we adapt to optimise the signal characteristics of myelinated and unmyelinated structures within the brain. At birth the T1 time of the white matter is about 1600ms and 550 at 12 months at 1.5T, whereas the T2 time is 90ms and 5ms respectively. These changes need to be reflected in parameters that must be age corrected. Also keep in mind that T1 time is field strength dependent.

The choice of T1-weighted sequence will reflect the preferences of the group performing the study. The Hammersmith group has shown exquisite images depicting the early stages of myelination using inversion recovery sequences. The key to accurately depicting these changes using inversion recovery sequences is the flexibility to change the inversion time as the biochemical structure of the brain changes. Unmyelinated brain has a longer T1 than the much shorter T1 time of myelinated and partly myelinated brain. In general the optimum IR time will be 69% of the T1 time of the brain.

Conventional SE or FSE seems to be the preferred option from a majority of sites. The key to providing adequate contrast differentiation between myelinated and unmyelinated structures is the increase in TR time to reflect the longer T1 relaxation times. The TE will often be the minimum and the TR chosen will vary from birth 1300ms to 600ms at 6 months. The effects of TR and TE on the developing brain were very nicely demonstrated by the group from Children's Hospital of Philadelphia in a recent Siemens publication.

T2-weighted imaging is ideally performed using fast spin echo techniques, whereby the optimisation of TR and TE will be chosen to enhance signal characteristics of the structures within the brain. The magnetization transfer effects of FSE imaging can increase the conspicuity of myelinated or non-myelinated structures. Unlike T1-weighted imaging where the TR is adjusted to reflect the stages of development, the TE is adjusted in T2-weighted sequences. In the neonatal period a long TE (160-180ms) is preferred, and this is adjusted to more conventional times (100ms) by 18 months of age. Fast recovery (Restore, Drive, FRFSE) T2-weighted sequences offer another avenue to promote these differences in signal characteristics.

The transition period (6-9 months) gray matter GM and white matter WM resulting in isointense is a challenge for protocols whereby the parameters chosen for standard T1 and T2 sequences may not adequately differentiate changes. T2-weighted inversion recovery sequences using a moderate inversion time (150ms) may be an option. Philips has approached the evaluation of the developing brain from a different perspective with dual inversion sequences to depict GM or WM and suppress cerebrospinal fluid CSF.

Alternative sequences such as FLAIR and Magnetization Transfer Ratios have been used with limited application to evaluating the brain. There is a great deal of debate at meetings as to the relative effectiveness of FLAIR in children under 12 months of age, as with T2-weighted sequences the TE required should be longer than a conventional FLAIR sequence e.g. 140ms. There is evidence in the literature that the utility of FLAIR in the first 9-12 months of life may provide additional diagnostic information that will complement conventional T1 and T2 imaging.

Diffusion weighted (DWI) sequences, preferably tensor (DTI) should be performed in all examinations for developmental questions. DWI/DTI has the ability to assess myelination and premyelination of the brain. As with conventional sequences, the changes associated with myelination will affect apparent diffusion and regional anisotropy values.

The imaging of the pediatric brain will always be a challenge as we modify pulse sequence parameters to optimise signal characteristics and battle signal to noise issues. The current MR systems have the potential to push the boundaries of resolution, but we as users must always balance the requirements of spatial resolution, signal to noise and scan times. More efficient coils and pulse sequences have addressed many of these issues.

Improvements in pulse sequence efficiency have given us the opportunity to utilize T1, T2 and FLAIR 3D techniques to provide high resolution isotropic voxels in an acceptable scan time. Many institutes use high resolution 3D T2 sequences in the first 6 months to look at cortical malformations and a standard 2D T1 for myelination. The improved signal characteristics of fast recovery sequences have improved the tissue contrast in 3D T2-weighted images.

The requirements for standard 3D T1-weighted images in this period provide an interesting challenge. Standard RF spoiled sequences are often preferred in this period due to consistent signal characteristics. Inversion prepared sequences that utilize centric phase encoding offer an alternative as variation of the inversion time like conventional 2D sequences may provide better visualization of the brain.

After the transition period (6-9 months) 2D T2-weighted (T2 and FLAIR) and 3D Inversion prepared (MPRAGE, IRFSPGR, etc.) are the current standard sequence options, but within a very short period of time we will see more papers demonstrating the increased acceptance of 3D sequences for T2 and FLAIR imaging. ●

Thanks go to Gregory Brown (Royal Adelaide Hospital), Andrew Cooper (Queens Medical Centre), and Kirsten Moffat (Philips Medical Systems) for their contributions to this article.

References

There are many excellent texts/references available that cover this topic in detail and I have listed a few below:

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MR Safety and the Reveal Plus Insertable Loop Recorder

Frank G. Shellock, Ph.D., Adjunct Clinical Professor of Radiology and Medicine, University of Southern California; Institute for Magnetic Resonance Safety, Education, and Research, Los Angeles, California, USA www.MRIsafety.com www.IMRSER.org

The 9526 Reveal Plus Insertable Loop Recorder (ILR, Medtronic, Inc., Minneapolis, Minnesota, USA) is an implantable, single-use, programmable device containing two surface electrodes for continuous recording of the patient's subcutaneous electrocardiogram.

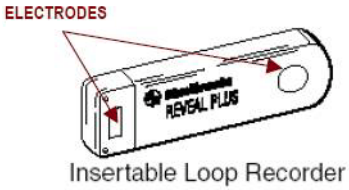
This device is indicated for patients who experience transient symptoms that may suggest a cardiac arrhythmia and for patients with clinical syndromes or situations that put them at increased risk of cardiac arrhythmias.

Implanting the Reveal Insertable Loop Recorder takes about 15 to 20 minutes and can be done under a local anesthetic in an outpatient setting. The physician makes an incision about 2-cm. in length, creating a pocket the same size and shape as the Reveal Insertable Loop Recorder device. Once the device is inserted in the subcutaneous pocket, it is programmed to record the ECG.

Because the Reveal Insertable Loop Recorder is capable of recording an ECG during an actual fainting episode, physicians are able to confirm or rule out an abnormal heart rhythm more definitively. Importantly, since this device may be utilized continuously for up to 14 months, the likelihood of capturing heart rhythm information during an infrequent fainting episode is excellent.

MR Safety and the Reveal Plus Insertable Loop Recorder

The Reveal Plus ILR contains no lead wires or large loops of electrically conductive material. The electromagnetic fields produced during magnetic resonance imaging may adversely affect the data stored by the Reveal Plus ILR. Therefore, before permitting a patient with this device into the MRI environment, consideration must be given to interrogating the Reveal Plus ILR in order to save the data that could become corrupted or erased as a result of undergoing an MRI procedure. Accordingly, careful planning in conjunction with the physician responsible for the patient's Reveal Plus ILR is necessary.



Insertable Loop Recorder

Also, since the ILR contains ferromagnetic components, strong magnetic fields associated with the MR system will exhibit mechanical force on the ILR. Accordingly, the patient may feel slight movement of the ILR. While this does not represent a safety hazard, the patient must be informed of this possibility to avoid undue concern.

Additional MRI-related information may be found in the "Reveal Plus 9526 Insertable Loop Recorder System Product Information Manual:"

- For information on how to interrogate and save data prior to MRI procedures, see "How to Interrogate the ILR" and "How to Save To Disk," both in Chapter 3.
- For information on resetting collection data/parameters following MRI procedures, see "Clearing Memory Without Changing Gain and Sensitivity Settings" in Chapter 2.
- For testing patient triggered storage integrity following MRI procedures, see "Storing an Event in a Clinical Setting" in Chapter 2.

(Information provided with permission, Medtronic, Inc., Minneapolis, Minnesota, USA, http://www.medtronic.com/reveal/rpmri.html). ●

References

1. Krahn A., Klein G, Yee R., Norris C. Final results from a pilot study with an implantable loop recorder to determine the etiology of syncope in patients with negative non-invasive and invasive testing. *American Journal of Cardiology* 82:117-119, 1998.
2. Reveal Syncope Validation Project (RSVP) Clinical Summary. Medtronic data on file.
3. Shellock FG, et al. Cardiac pacemakers, ICDs, and loop recorder: Evaluation of translational attraction using conventional ("long-bore") and "short-bore" MR systems at 1.5- and 3-Tesla. Journal of Cardiovascular Magnetic Resonance 5:387-397, 2003.

Using MR Spectroscopy in the Evaluation of HIV-Related Dementia

Robin Greene-Avison, C.N.M.T. (R)(N)(MR), Manager, Institute for Imaging Sciences, Vanderbilt University, Nashville, Tennessee, USA

HIV dementia (HIVD) is currently a common problem in AIDs patients. HIVD was not observed in the early past of the AIDs explosion in the United States because the infected persons would likely die of the result of some disease or infection that resulted from compromised immune response caused by the AIDs infection.

With the current success of highly active anti-retroviral therapies (HAART), patients are living longer than they previously have. Unfortunately, with the extended mortality with HAART, it is now discovered that approximately two-thirds of AIDs infected individuals develop HIV-related dementia.

HIVD is characterized by motor, behavioral, and cognitive impairments which may progress to become severe enough that the individual may suffer from an inability to function occupationally or socially.

Disruption of the blood brain barrier (BBB) during the course of the HIV replication, has been postulated as one of the mechanisms contributing to the development of HIVD. In addition to crossing through a compromised BBB, the HIV can enter the central nervous system (CNS) within days to weeks of infection by trafficking into the brain by hiding in macrophages (the "Trojan Horse model"). Once in, the HIV accumulates many mutations in the course of infection in a single individual. The rapidity of replication is a staggering 10^9-10^{10} virions/day.

Despite our progress in understanding the biochemical mechanisms of HIV-mediated CNS damage, it remains difficult to predict which individuals will eventually develop HIVD and how they may respond to therapy.

Magnetic Resonance Spectroscopy (MRS) reveals metabolic changes that coincide with neurological testing scores used to evaluate an individual's level of dementia. This is an important finding in that the MRS can provide useful information regarding HIVD progression and responses to therapy.

Figure 1 is a spectrum of the expected metabolic peaks seen in a long echo, proton, single voxel spectrum placed in the putamen area of the brain.

The double peak identified by letter A is called the *myo*-Inositol peak (mI), and it represents an important marker in HIVD because it represents glial activation in response to the immune response to the virus. Glial activation recruits cytokines and chemokines both of which are neurotoxic and, therefore, the mI peak increases as individual's HIVD status worsens.

The peak identified as B is Choline (Cho), which is a marker of cell proliferation. Elevated Cho is observed in a

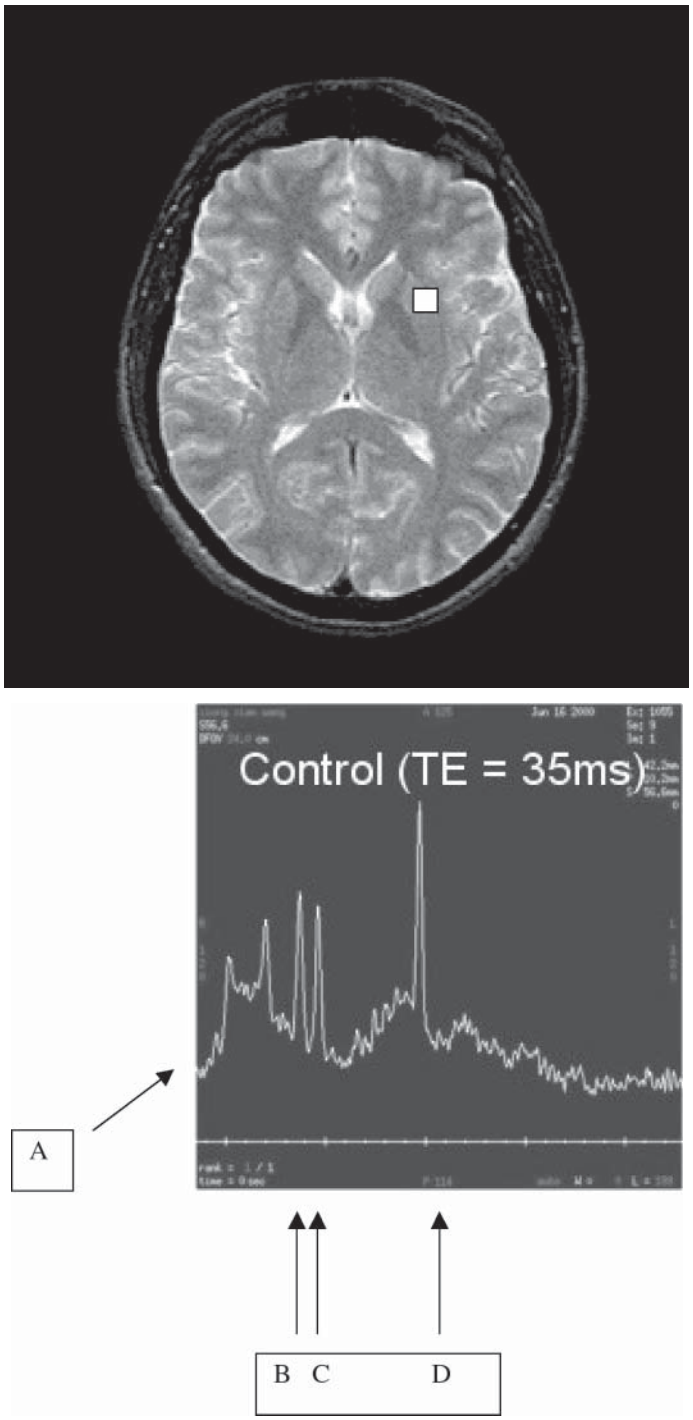


Figure 1.

Continued on page 10

variety of inflammatory CNS disorders, where it appears to reflect increased cellularity and macrophage infiltration, as well as membrane degradation associated with demyelination.[1]

The peak identified as C is Creatine (Cr), and Cr levels stay pretty similar between neuronal and non-neuronal cell types, so it serves as a useful, stable metabolic marker by which other metabolic ratios are compared. Frequently, you will see metabolic measurements made as metabolic/Cr ratios.

The peak identified as D is N-acetyl aspartate (NAA), and this represents a neuronal marker which is reduced irreversibly with neuronal loss but reversibly with stress.

These observations can be seen in the following pair of spectra whereby the first spectrum (a) represents spectra from the white matter of a healthy normal control, as compared the second spectrum (b) from the same region of the brain in an HIVD individual:

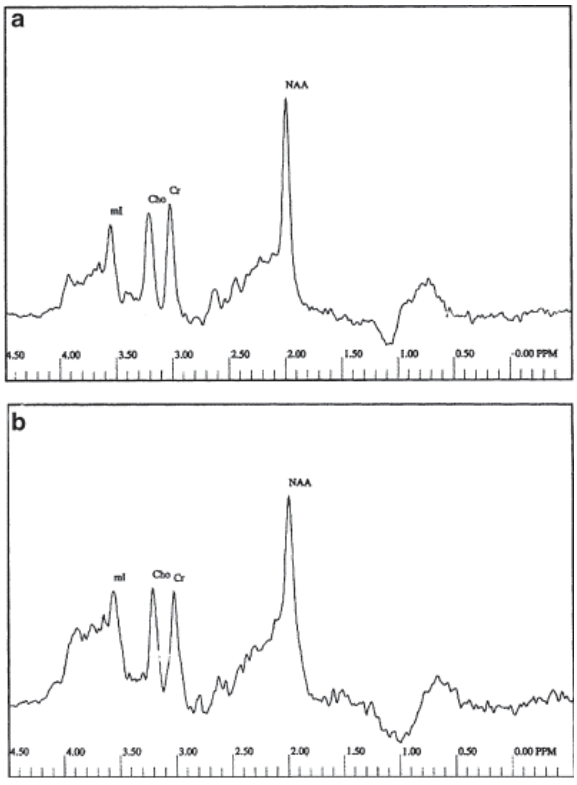


Figure 2.

Significant reductions in the mean area ratios of Naa/Cr, and the elevations of Cho/Cr and mI/Cr, correlate with HIVD patient dementia test scores. Monitoring these ratios may provide useful information with regard to the progression of the situation. It may also be useful one day in predicting the dementia before the symptoms appear. Additionally, because HAART can reverse or slow HIVD in some individuals, MRS may become a valuable measurement tool for customization of therapy. ●

References

1. Avison M., et al. Understanding Pathogenis and Treatment of HIV Dementia. *Trends in Neurosciences,* Vol. 25 No. 9, Sept 2002.

Upcoming 1-Day SMRT Regional Seminars–

Southeast Regional Educational Seminar

Saturday, 18 September 2004

Atlanta, Georgia, USA

Carolyn Brown, R.T. (R)(MR), Co-Chair
Bobbie Burrow, R.T. (R)(MR)(CT), Co-Chair
Donna O'Brien, R.T. (R)(MR)(CT), Co-Chair

VENUE:
Saint Joseph's Hospital, Educational Auditorium, Ground Floor, 5665 Peachtree Dunwoody Road, Atlanta, Georgia, USA

HOSTED BY: The SMRT Atlanta Local Chapter

PROGRAM: 08:00 - 16:45

08:00 Registration, Welcome, and Announcements

08:30 **Cardiac Imaging Update**
Salil Patel, M.D.
Cardiologist, Emory University School of Medicine, Atlanta, Georgia, USA

09:25 **Physics: Part 1**
Carolyn K. Roth, R.T. (R)(MR)(CT)(M)(CV)
Director of Continuing Education and MRI Programs, University of Pennsylvania Medical Center, Philidelphia, Pennsylvania, USA

10:15 Break

10:30 **Physics: Part 2**
Carolyn K. Roth, R.T. (R)(MR)(CT)(M)(CV)
Director of Continuing Education and MRI Programs, University of Pennsylvania Medical Center, Philidelphia, Pennsylvania, USA

11:25 **Understanding Pathogenesis and Treatment of HIV Dementia: A Role for Magnetic Resonance?**
Robin Greene-Avison, R.T. (N)(MR), C.N.M.T.,
Manager, Institute for Imaging Science, Vanderbilt University, Nashville, Tennessee, USA

12:15 Lunch

13:00 **Abdominal MRI/MRA Imaging**
Diego R. Martin, M.D., Ph.D.
Director of Abdominal Imaging, Emory University Hospital, Atlanta, Georgia, USA

13:55 **Changing Gears**
Rita E. Clemons, R.T. (R)(MR)
Senior MRI Technologist, Medical Center at Lancaster, Lancaster, Texas, USA

14:45 Break

15:00 **Open MRI Imaging**
James J. Stuppino, B.S., R.T. (R)(MR)
Director/Co-Owner, Valley Advanced Imaging, Bethlehem, Pennsylvania, USA

05:55 **Musculoskeletal MRI**
Cindy T. Hipps, B.H.S., R.T. (R)(MR)
MRI Coordinator, Greenville Radiology, PA, Greenville, South Carolina, USA

16:45 Adjourn

HOTEL INFORMATION:
Courtyard by Marriott, Medical Center
5601 Peachtree Dunwoody Road, Atlanta, Georgia, USA
+1 800 321 2211 +1 404 843 2300

Upcoming 1-Day SMRT Regional Seminars–

Northeast Regional Educational Seminar

Saturday, 25 September 2004
New York, New York, USA

Cindy R. Comeau, B.S., R.T., (N)(MR), Co-Chair
Carol Finn, R.T. (R)(MR), Co-Chair

VENUE:
New York Presbyterian Hospital & Milstein Hospital,
Clark Conference Room 1 & 2, First Floor,
177 Fort Washington Avenue, New York, New York, USA

PROGRAM: 07:30 - 17:00

07:30 Registration

08:00 Welcome and Introductions

08:10 **Advanced Pulse Sequences**
William Faulkner, B.S., R.T. (R)(MR)(CT)
Vice President, OutSource, Inc., and MRI Consultant, William Faulkner & Associates, Chattanooga, Tennessee, USA

09:00 **MRI of Congenital Heart Disease**
Frank Macaluso, B.S., R.T.
Research Operations Manager, Mt. Sinai Medical Center, New York, New York, USA

09:50 Break

10:00 **Advances in Cardiac MRI**
Gary McNeal, M.S.
Advanced Applications Specialist, Siemens Medical Solutions, Iselin, New Jersey, USA

11:00 **MRI Safety Update**
Frank G. Shellock, PhD.
Adjunct Clinical Professor of Radiology and Medicine, Keck School of Medicine, University of Southern California, Institute for Magnetic Resonance Safety, Education, and Research, Los Angeles, California, USA

11:50 Lunch

13:00 **What You Need to Know About 3T**
David Stanley, B.S., R.T. (R)(MR)
Advanced MRI Applications/Research Specialist, GE Medical Systems, Milwaukee, Wisconsin, USA

13:50 **Vascular MRA: Update**
Steven D. Wolff, M.D., Ph.D.
Director Cardiovascular Imaging, Advanced Cardiovascular Imaging, New York, New York, USA

14:40 Break

15:00 **New MRI Techniques**
Lawrence N. Tannenbaum, M.D.
Assistant Professor, Department of Neuroscience, Seton Hall University; Section Chief Neuroradiology, MRI & CT, New Jersey Neuroscience Institute, J.F.K. Medical Center, Edison, New Jersey, USA

15:50 **MR Spectroscopy: Current Status and Future Possibilities**
James Stuppino, B.S., R.T. (R)(MR)
Director/Co-Owner, Valley Advanced Imaging, Bethlehem, Pennsylvania, USA

16:40 Closing Discussion

17:00 Adjourn

HOTEL INFORMATION:

Hilton Fort Lee George Washington Bridge
2117 Route 4 Eastbound, Fort Lee New Jersey, USA +1 201 461 9000

For those who want more of a New York experience:
Qualilty Inn Times Square
157 West 47th Street, New York, New York, USA +1 212 768 3700

Northeast Regional Educational Seminar

Saturday, 2 October 2004
Boston, Massachusett, USA

Carolyn Bonaceto, B.S., R.T. (R)(MR), Co-Chair
Michael Dunlap, B.S., R.T. (R)(MR)(CT), Co-Chair

VENUE:
Beth Israel Deaconess Medical Center
Carl J. Shapiro Conference Room, 10th Floor
Boston, Massachusetts, USA

PROGRAM: 07:30 - 16:30

07:30 Registration, Welcome, and Announcements

08:00 **Advances in Body Imaging at 3T**
Neil M. Rofsky, M.D.
MRI Physician Director, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

09:00 **An Analytical Approach to MRI Purchasing Decisions**
Herbert Y. Kressel, M.D.
Radiologist-in-Chief, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

10:00 Break

10:10 **Obstetrical MRI– Maternal and Fetal**
Deborah Levine, M.D.
Director, Ultrasound Ob/Gyn, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

11:10 **Data Manipulation in MRI**
Stephen J. Powers, B.S., R.T. (R)(MR)(CT)
Site Manager, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

12:10 Lunch

13:00 **Parallel Imaging Today and Tomorrow**
Daniel K. Sodickson, M.D., Ph.D.
Director, Laboratory for Biomedical Imaging Research, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

14:00 **Breast MR Spectroscopy**
Robert E. Lenskinski, Ph.D.
Director, Experimental Radiology, Associate Chief for Academic Affairs, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

14:50 Break

15:00 **MRI of the Prostate**
Boris Nicolas Bloch, M.D.
MRI Research Fellow, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

15:55 Discussion/Questions and Comments

16:30 Adjourn

HOTEL INFORMATION:

Best Western Boston – The Inn at Longwood Medical
342 Longwood Avenue, Boston, Massachusetts, USA
+1 617 731 4700

Upcoming 1-Day SMRT Regional Seminars–

President's Regional Educational Seminar

Saturday, 9 October 2004
Charleston, South Carolina, USA

Cindy T. Hipps, B.H.S., R.T. (R)(MR), Chair, SMRT President

VENUE:
Medical University of South Carolina, Thurmond Gazes Research Building, Solomon Conference Room, 114 Doughty Street, Charleston, South Carolina, USA

PROGRAM: 07:30- 16:50

07:30 Registration and Continental Breakfast

08:00 **MRI of the Breast**
Anne Sawyer-Glover, B.S., R.T. (R)(MR)
Manager, MR Whole Body Research Systems, Richard M. Lucas Center for MRS/I, Stanford University School of Medicine, Stanford, California, USA

08:50 **Cardiac MR**
Robert C. Rollings, M.D.
Cardiologist, Savannah Cardiology, PA, Greenville, South Carolina, USA

09:40 Break

10:00 **Body MR**
Steven Lowe, M.D.
Body MR Director, Greenville Radiology, Greenville, South Carolina, USA

10:50 **ACR Quality Control**
William Geoffrey West, M.Eng., C.H.P.
Consultant,West Physics Consulting, Atlanta, Georgia, USA

11:40 Lunch

12:20 **MRI Safety Update**
Frank G. Shellock, Ph.D.
Adjunct Clinical Professor of Radiology and Medicine, Keck School of Medicine, University of Southern California, Institute for Magnetic Resonance Safety, Education, and Research, Los Angeles, California, USA

13:10 **Advanced MR and Future Applications**
Carolyn Kaut Roth, R.T. (R)(MR)(CT)(M)(CV)
Director of Continuing Education and MRI Programs, University of Pennsylvania Medical Center, Philidelphia, Pennsylvania, USA

14:00 Break

14:20 **Spectroscopy and Clinical Trials**
Maureen D. Ainslie, M.S., R.T. (R)(MR)
Manager, Duke Image Analysis Lab, Duke University, Durham, North Carolina, USA

15:10 **Head and Neck Neuro-Anatomy**
A. Ronald Cowley, Ph.D., M.D.
Director of Neuroimaging, Greenville Radiology, Greenville, South Carolina, USA

17:00 Adjourn

HOTEL INFORMATION:

Courtyard by Marriott Charleston Riverview
35 Lockwood Drive, Charleston, South Carolina, USA

Call +1 800 321 2211 to reserve a room "SMRT-Group" name for special rate by 8 September to receive the special group rate.

Charleston Riverview Hotel
170 Lockwood Boulevard, Charleston, South Carolina, USA

Call +1 800 968 3569 to reserve a room "SMRT-Group" name for special rate by 8 September to receive the special group rate.

Central Regional Educational Seminar

Saturday, 23 October 2004
Provo, Utah, USA

Randy Earnest, B.S., R.T. (MR)(R), Chair
Janet Panter, R.T. (MR)(M)(R), Co-Chair

VENUE:
Utah Valley Regional Medical Center,
1034 North 500 West
IHC University Building, Provo, Utah, USA

PROGRAM: 07:30 – 17:00

07:30 Registration and Continental Breakfast

07:55 Welcome and Announcements

08:00 **Current Trends in MR**
David Anderson, M.S., R.T. (R)(MR)
Regional MR Coordinator, Intermountain Health Care, Salt Lake City, Utah, USA

09:00 **Emerging Trends in MR**
Dennis Parker, Ph.D.
Physicist, Professor, Radiology Department, University of Utah, Salt Lake City, Utah, USA

10:00 Break

10:15 **Cardiac MR**
Jeff Anderson, M.D.
Cardiologist, LDS Hospital, Salt Lake City, Utah, USA

11:15 **Genitourinary MR**
Roy Hammond, M.D.
Radiologist, Utah Valley Regional Medical Center, Provo, Utah, USA

12:15 Lunch

13:00 **Breast Imaging**
David Anderson, M.S., R.T. (R)(MR)
Regional MR Coordinator, Intermountain Health Care, Salt Lake City, Utah, USA

14:00 **MRA**
James J. Stuppino, B.S., R.T. (R)(MR)
Director/Co-Owner, Valley Advanced Imaging, Bethlehem, Pennsylvania, USA

15:00 Break

15:15 **MR Imaging Agents**
Wendell Gibby, M.D.
Radiologist, Riverwoods Medical Center, Provo, Utah, USA

16:15 **MR Safety**
James J. Stuppino, B.S., R.T. (R)(MR)
Director/Co-Owner, Valley Advanced Imaging, Bethlehem, Pennsylvania, USA

17:15 **SMRT**
Nanette Keck, R.T. (R)(MR)
Applications Specialist, Medrad, Salt Lake City, Utah, USA

17:30 Adjourn

HOTEL INFORMATION:

Marriott Provo, 101 West 100 North, Provo, Utah, USA
+1 801 377 4700 +1 800 777 7144

La Quinta Inn Provo, 1555 North Canyon Rd., Provo, Utah, USA
+1 210 616 7606

Courtyard Provo, 1600 North Freedom Blvd., Provo, Utah, USA
+1 801 373 2222 +1 800 321 2211

Upcoming 2-Day SMRT Regional Seminar–

West Regional Educational Seminar

Saturday, 6 and Sunday, 7 November 2004
Stanford University School of Medicine, Stanford, California, USA

Anne M. Sawyer-Glover, B.S., R.T. (R)(MR), Co-Chair
Jane W. Johnson, R.T. (R)(MR), Co-Chair

VENUE: Stanford University School of Medicine, Medical School Building M, Room M-106
300 Pasteur Drive, Stanford, California, USA +1 650 725 9697

PROGRAM: Saturday November 6, 2004, 08:00 – 17:00

08:00 Registration and Welcome
Anne M. Sawyer-Glover, B.S., R.T. (R)(MR)
Manager, MR Whole Body Research Systems, Richard M. Lucas Center for MRS/I, Stanford University School of Medicine, Stanford, California, USA

08:10 **Introduction to Nuclear Magnetic Resonance**
Daniel M. Spielman, Ph.D.
Associate Professor, Stanford University, Stanford, California, USA

09:05 **MR Image Contrast**
Michael E. Moseley, Ph.D.
Associate Professor, Stanford University, Stanford, California, USA

10:00 Break

10:15 **Optimizing MR Protocols at Mid- and Low-Field Field Strength**
James J. Stuppino, B.S., R.T. (R)(MR)
Director/Co-Owner, Valley Advanced Imaging, Bethlehem, Pennsylvania, USA

11:10 **MR of the Spine**
Barton Lane, M.D.
Professor, Stanford University, Stanford, California, USA

12:05 Lunch

13:05 **MRA Techniques**
Marcus Alley, Ph.D.
Research Associate, Stanford University, Stanford, California, USA

14:00 **MR of the Abdomen**
Larry Chow, Ph.D.
Assistant Professor, Stanford University, Stanford, California, USA

14:55 Break

15:10 **MR Image Artifacts**
Robert J. Herfkens, M.D.
Professor, Stanford University, Stanford, California, USA

16:05 **Musculoskeletal MRI**
Garry E. Gold, M.D.
Assistant Professor, Stanford University, Stanford, California, USA

PROGRAM: Sunday November 7, 2004, 08:00 – 17:00

08:00 Welcome
Jane W. Johnson, R.T. (R)(MR)
Research Application Specialist, Stanford University, Stanford, California, USA

08:10 **Basics of MR Spectroscopy**
Daniel M. Spielman, Ph.D.
Associate Professor, Stanford University, Stanford, California, USA

09:05 **Cardiac MRI: Basic Principles and Applications**
Cindy R. Comeau, B.S., R.T. (N)(MR)
Manager, Cardiovascular MRI, Advanced Cardiovascular Imaging, Cardiovascular Research Foundation, New York, New York, USA

10:00 Break

10:15 **Diffusion- and Perfusion-Weighted MRI of the Brain**
Pratik Mukherjee, M.D., Ph.D.
Assistant Professor, University of California at San Francisco, San Francisco, California USA

11:10 **MR of Kidneys and Pelvis**
F. Graham Sommer, M.D.
Professor, Stanford University, Stanford, California, USA

12:05 Lunch

13:05 **Parallel Imaging Techniques**
Anja Brau, Ph.D.
Advanced Development Specialist, G.E. Healthcare/ASL West, Menlo Park, California, USA

14:00 **MR Imaging of the Breast**
Bruce L. Daniel, M.D.
Assistant Professor, Stanford University, Stanford, California, USA

14:55 Break

15:10 **MR Contrast Agents**
Michael E. Moseley, Ph.D.
Associate Professor, Stanford University, Stanford, California, USA

16:05 **Screening and Safety**
Robert J. Herfkens, M.D.
Professor, Stanford University, Stanford, California, USA

Anne M. Sawyer-Glover, B.S., R.T. (R)(MR)
Manager, MR Whole Body Research Systems, Stanford University, Stanford, California, USA

HOTEL INFORMATION:

Westin Hotel, 675 El Camino Real, Palo Alto, California, USA	+1 800 937 8461	+1 650 321 4422
Sheraton Hotel, 625 El Camino Real, Palo Alto, California, USA	+1 800 874 3516	+1 650 328 2800
Best Western Riviera, 15 El Camino Real, Menlo Park, California, USA	+1 800 528 1234	+1 650 321 8772
Stanford Terrace Inn, 531 Stanford Avenue, Palo Alto, California, USA	+1 800 729 0332	+1 650 857 0333
Marriott Courtyard, 4320 El Camino Real, Los Altos, California, USA	+1 800 236 2427	+1 650 941 2866

2004 2nd Place Proffered Paper Oral Presentation, Research Focus–

Use of Guidance Software during MR Breast Interventional Procedures

Joanne Muldoon, M.R.T. (R)(MR), Caron Murray, R.T., A.C.R., (R)(MR) C.A. Piron, D.B. Plewes, P. Causer
Department of Imaging and Bioengineering Research and Medical Imaging, Sunnybrook and Women's College Health Science Center, Toronto, Ontario, Canada

Purpose

MRI has proven to be successful in the imaging of suspicious lesions that are occult on mammography and ultrasound (US). However, in those cases where lesions are not seen on US or mammography, an MRI guided method must be used for tissue sampling. The importance of performing this type of intervention quickly and accurately presents many challenges for both the MR technologist and radiologist. Currently, there is no standard technique for calculating and recording the locations for needle positioning during interventional procedures. Common practice involves using a fiducial skin marker that is placed over the expected lesion site as a guide to visually assess and calculate these co-ordinates. We have developed a unique guidance software program that has become a useful tool in the performance of needle localizations, vacuum assisted biopsies, and MR/US co-registration. It is designed with an interface to reduce potential user error and reduce the time from lesion visualization to needle insertion. As well, the software will determine the shortest approach (medial/lateral) for needle insertion and has the capabilities to facilitate multiple needle placements rapidly. The purpose of this study is to discuss how the use of this software improves the accuracy and efficiency of all breast interventions and how its implementation impacts the role of the MR technologist during these procedures.

Material and Methods

All interventional breast procedures require the use of two MR technologists; one to perform the scanning and the other to assist the radiologist with the patient and to perform data entry into the guidance software. The guidance software is run from a laptop situated beside the user console. The technologist selects the software settings depending on the procedure being performed. Stereotactic referencing involves the imaging of a pair of fiducial markers that are embedded into specially designed compression plates. Three separate imaging sequences are used to determine the co-ordinates of the fiducial markers on the medial/lateral plates before the injection of contrast. A sagittal T1W F.S. 2D FSPGR sequence with an I.V. injection of 0.1mm/kg concentration is performed to determine the location of the enhancing breast lesion. While the dynamic scan is running, the technologist will enter the fiducial co-ordinates into the laptop. Once the lesion is visualized, the technologist then enters the lesion co-ordinates into the localization program. The technologist then chooses either a medial or lateral approach. The system outputs the closest access window to the target, the closest plughole to the target center and the required depth of the localization needle. A graphical interface is displayed on the computer to help the radiologist identify positions on the apparatus. The patient is then removed from the bore, the radiologist positions the needle according to the software calculated positions and verification scans are performed. A similar approach was also used to aid the positioning of an US probe to provide co-registered MRI/US imagery.

Results

The guidance software has been used for 60 procedures in the MR. 32 MR-guided wire localizations, 6 MR-guided core biopsies, 2 MR-guided vacuum assisted biopsies and 20 MR/US co-registrations. Of the 32 wire localizations, 38 wires were delivered. A total of 27 lateral approaches and 11 medial (approx. 30%) were performed. Six of these procedures involved multiple needle deliveries, and 1 patient required bilateral localization. All needle placements were verified to be within the boundaries of the lesion on the first attempt (only needle depth repositioning required). The mean error was found to be 4.6mm. The average time from patient set-up to removal of apparatus was 62 minutes. The average elapsed time from first localizer scans to final verification images was 33 minutes. The average time from lesion visualization to needle verification was 7.9 minutes. The average time for positioning and verifying 2 wires was 9.8 minutes. Needle repositioning in sagittal plane was required only once, and needle repositioning in axial plane (primarily to account for tissue shift) was required 17 times.

Discussion

The use of MRI intervention guidance software to calculate the required needle position has proved to be a fast, easy and reliable technique for performing breast interventions in the MR. It plays an important role in the reduction of time between lesion visualization and needle verification. This time frame is critical due to decreasing lesion conspicuity after the injection of contrast. Its versatile platform is easy for the technologist to learn and operate and eliminates any guesswork on the part of the radiologist. The implementation of this software enables the technologist to play a more integral role in the assistance of the radiologist during interventional procedures. The advantages of this software and validation of its use in a variety of procedures has significantly improved the efficiency and accuracy of breast interventions performed in the MR with the ultimate goal of optimizing patient care. ●

2004 2nd Place Proffered Paper Oral Presentation, Clinical Focus–

Optimization of Contrast-Enhanced Peripheral MR Angiography with Mid-Femoral Venous Compression (VENCO)

Sandra Massing, Florian M. Vogt, Christoph U. Herborn
Department of Diagnostic and Interventional Radiology, University Hospital Essen, Essen, Germany

Purpose

To compare a standard protocol for contrast-enhanced three-dimensional Magnetic Resonance Angiography (3D CE-MRA) of the lower extremities to a high spatial resolution protocol with venous compression ('VENCO') at the mid-femoral level.

Method and Materials

Twelve patients with peripheral arterial occlusive disease were examined once with a standard MR Angiography (MRA) protocol, and a second time with a high spatial resolution protocol in combination with mid-femoral venous compression (60 mmHg) for the last two stations. All imaging was performed on a 1.5 T whole-body MR scanner (Magnetom Sonata,® Siemens Medical Systems, Erlangen, Germany) using a dedicated peripheral vascular coil with eight separate circularly polarized elements extending over 140 cm in conjunction with two surface body array coils.

For all MRA examinations, a commercially available paramagnetic contrast agent (Gd-BOPTA, MultiHance,® Bracco, Milan, Italy) was administered intravenously at a weight-adjusted dose of 0.2 mmol/kg. Contrast material was injected automatically (Spectris, MEDRAD, Pittsburgh, Pennsylvania, USA) with a biphasic protocol: the first half was injected at a rate of 1.2 ml/s, while the second half was administered at a rate of 0.6 ml/s, followed by a 20 ml saline flush (1.2 ml/s). Based on a 'moving vessel scout' and subsequent acquisition of non-enhanced data masks of the four stations for subsequent subtraction four consecutive 3D data sets were planned. All images were collected in the coronal plane using a fast 3D T1-weighted GRE-sequence with Care Bolus® timing for optimal vascular enhancement. In both protocols the first two stations were imaged using a TR / TE of 2.48 / 1.02 ms and a matrix of 384 resulting in an acquisition time of 14 seconds.

With 'VENCO' the last two stations were imaged with a sequence characterized by a higher spatial resolution and a longer acquisition time (1.2 mm^3, 25 sec vs. 0.9 mm^3, 47 sec). For venous compression a 30 cm wide thigh blood pressure cuff was placed at the mid-femoral level and manually adjusted to a permanent pressure of 60 mmHg from the start of the contrast injection to the end of the exam.

Signal-to-noise ratios (SNR) and contrast-to-noise ratios (CNR) were calculated and image quality as well as venous overlay were assessed on a five-point scale for both examinations. Statistical analysis was performed with a significance level at $p < 0.05$.

Results

Mean SNR and CNR values of the two lower stations with 'VENCO' were statistically significantly higher in comparison to the 'standard' protocol (66 ± 8 vs. 52 ± 11 and 53 ± 9 vs. 41 ± 8, respectively; $p < 0.01$). The same was true for overall image quality with 'VENCO' (4.0 ± 0.2 vs. 3.4 ± 0.8; $p < 0.05$) and presence of venous overlay (4.0 ± 0.2 vs. 3.4 ± 0.8; $p < 0.05$), respectively.

Conclusion

'VENCO' 3D CE-MRA is simple to put into practice and is most likely to advance the performance of multi-station MRA strategies for assessment of the peripheral arterial vasculature. ●

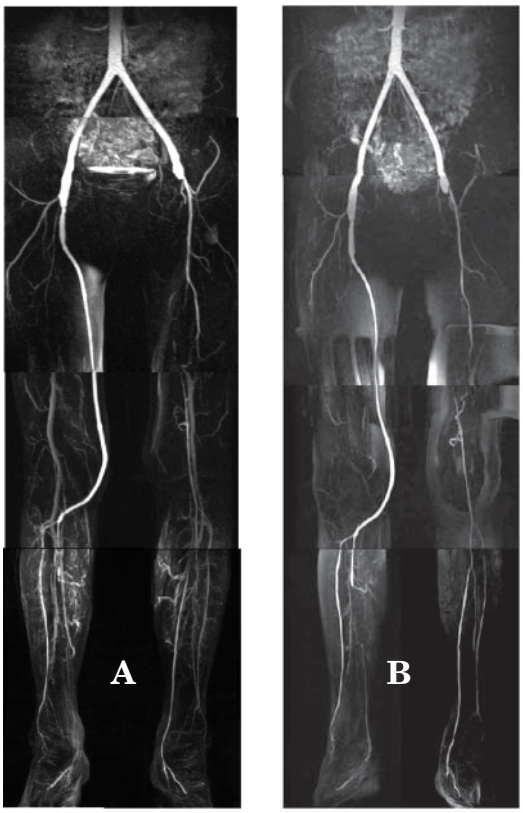


Figure 1. *Patient with peripheral arterial disease and history of femoro-popliteal bypass grafting of the right leg (Fontaine III).* ***A*** *shows the CE-MRA with the standard protocol,* ***B*** *is with VENCO and high spatial resolution for the two distal stations. Note the reduced venous overlay of the crural vasculature in* ***B****.*

2004 2nd Place Proffered Paper, Research Poster–

Can fMRI Studies Be Performed Across Scanners? A Comparison of fMRI Results between Two 3T Scanners

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Purpose

As functional MRI (fMRI) studies become more ambitious, including more subjects and performed over longer periods of time, the issue of pooling data across scanners is becoming more relevant and pressing. While it is common practice to maintain as much consistency as possible regarding scanning procedure, including the use of the same scanner for serial studies, we believe that the intra-scanner variability is considerably lower than the intra-operator variability between runs, days, sessions and scanners (3T GE scanners) presuming the use of the same subject. This preliminary study was aimed at demonstrating that the variability between scanners is at most, on the same order of magnitude as between runs and sessions.

Materials and Methods

The studies were performed on two separate 3 Tesla scanners (General Electric, Waukesha, Wisconsin, USA), but trying to keep the procedures as identical as possible. The subject was female and right handed. Her head was immobilized with extra padding to reduce possible head motion. The visual stimulus consisted of a flashing checkerboard (8 Hz) with a fixation cross. The images were projected from the control room onto back projection screen in the scan room where the subject was able to view the stimulus through a mirror, mounted on the standard GE transmit/receive birdcage head coil.

Imaging Parameters

Scanning was performed on two different 3T scanners using the standard GE head coil. 3T1 is a GE/Signa VH/I head only scanner and 3T2 is a GE/Signa VH4 whole body scanner. The pulse sequences acquired were echo-planar real-time imaging (EPI) and a Fast SPGR (MP-Rage). A total of 4 EPI runs were collected using the following parameters: 2D, axial, GRE-EPI, 1 shot, 30 TE, 2000 TR, 90° Flip, 24 FOV, 5mm slice thickness, 0 spacing, 1 nex, 64x64 matrix, R/L freq, ramp sampling enabled, 4 dummy scans, 130 repetitions, phase correction on. The MP-RAGE parameters: axial, 2D FSPGR, IR prep, TE min full, prep time: 725 flip 6°, bandwidth 31.25, 22FOV, slice thickness 1.2mm, locs per slab 128, matrix 224x224, 1 NEX, autoshim on. A MP-RAGE image was used to overlay the functional data.

Tasks

The subject was instructed to tap her fingers at a steady pace when she saw the flashing checkered board. The timing was after an initial 20sec, 20sec on and 40 sec off. Each series consisted of five alternating periods of rest and activation. These runs were repeated four times for each scanner.

Results

Shown in Figure 1 are the functional overlap maps across scanners and across runs for 3T1 and 3T2 created using AFNI.[1] After setting a Bonferroni-corrected p-value of 0.01 for a threshold for each run, we computed the number of activated voxels, the degree of overlap between runs and scanners, and the temporal signal to noise values between runs and scanners. Table 1 summarizes this. In these preliminary results, we show that the variation between runs in temporal signal to noise and number of voxels is at least less than the variation between scanners. We hypothesize that the between scanner location differences may be more due to variation between scanning session (i.e. shimming and subject arousal) rather than scanner specific effects.

Conclusion

Variation between scanners (at least of the same field strength and vendor) is not a significant source of variability in fMRI data. More data needs to be collected on the same subject across sessions and across scanners to demonstrate conclusively that session to session variability is a larger source of variability than scanner to scanner variability. These studies are ongoing.

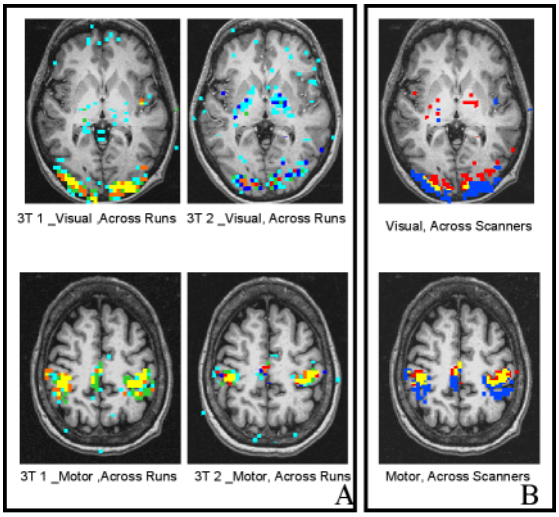

Figure 1. *A) Overlap across runs. Yellow= all runs. Aqua= 1 run. B) Overlap across scanners Yellow= overlap. Red= 3T2. Blue= 3T1.*

References

1. Cox RW, *Comput Biomed Res.* 1996 Jun; 29(3):162-73

Table 1: Number of activated voxels and temporal SNR across runs for each scanner.

		Number of Voxels	Temporal SNR
3T-2	Run 1	475	84.4
	Run 2	166	62.9
	Run 3	770	72.3
	Run 4	480	78.4
	Run 5	547	70.6
	Run 6	1157	72.5
	Average	599.2 +/- 334.8	73.5 +/- 7.3
3T-1	Run 1	713	58.4
	Run 2	1441	80.4
	Run 3	850	81.1
	Run 4	720	71.5
	Average	931 +/- 345.8	72.9 +/- 10.8

2004 2nd Place Proffered Paper, Clinical Poster–

Case Report: Clinical Use of Susceptibility Weighted MR Venograph

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Introduction

The use of T2* weighted multi-shot gradient echo imaging in combination with Minimum Intensity Projection (MinIP) display can provide high-resolution images of the cerebral microvasculature. The MR-Venograph [1, 2] is based not on blood flow but on blood oxygenation. At field strengths at or above 3T, the T2* of venous blood is considerably less than that of cortical tissue. Because of this, veins are readily apparent in T2*- weighted images and even more so in multi-slice MinIP displays. Here we report a patient with intractable epilepsy referred for whole brain MR-Venograph research scans prior to surgical intervention. The research scans were intended to identify and further define brain lesions that may produce an epileptic focus.

Methods

Male, 29 years old, right-handed, was being evaluated for surgical treatment of medically intractable complex partial epilepsy. Clinically relevant and research MR scans were performed on a 3.0 T General Electric Signa VH/i MRI scanner (3T/90cm, whole body gradient inset 40mT/m, slew rate 150 T/m/s) utilizing a transmit/receive birdcage head coil (IGC-Medical Advances, Milwaukee, Wisconsin, USA). A vacuum pillow with a six-liter fill (Vac-u-Fix, Houston, Texas, USA) immobilized the subject's head. Scan locations were planned using a standard, product-provided spoiled gradient recalled echo sequence in three planes (SPGR). Though not considered essential, the research scans were performed with and without the contrast agent Gd-DTPA (Magnevist, Berlex Laboratories). Non-ferrous fiducial markers (IZI Medical Products, Baltimore, Maryland, USA) were placed on the skin to facilitate later fusion of this study with functional brain mapping and Magnetoencephalography (MEG) data sets. Clinically relevant scans (for the radiology department) included: T1-weighted 3D SPGR, Axial FSE- PD-weighted and T2-weighted, Axial FSE. The research scans included: 3D Magnetization Prepared Rapid Gradient Echo (MP-RAGE), Pre and Post Gd- DTPA: 1.1mm thick/ 0 skip; TE: MinFull, TI: 725ms: flip angle 6°, bandwidth: 31.25 kHz, FOV 24cm x 24cm, matrix size 256 x 192, NEX =1. The MRV imaging with 3D SPGR included the following parameters: gradient moment nulling (Flow Comp),TR: 50ms, TE: 30ms, flip angle 20°, FOV 24cm x 24cm, 1.1mm slice thickness, 0mm gap, matrix size was 512 x 256, NEX =1. All Images were exported to a computer workstation for post-processing with Analysis of Functional Neuro-Imaging (AFNI) [3] software. The minimum intensity projection post-processing slabs varied across 4-5 slices, depending on physician preference.

Results and Discussion

The venous architecture was clearly visualized. The MRV (SWI) technique highlighted the increased vascular density and multiple cavernous angiomas of the left cerebral hemisphere (B,C), including a previously undetected cavernous angioma of the medial temporal lobe (A), adding to the anatomical information previously acquired (images below).

There are several standard and well-documented imaging techniques available for evaluating arterial blood flow and large venous cerebral vasculature, including 2D and 3D Time-of-Flight (TOF) MR Angiography (MRA) and 2D and 3D Venous Phase Contrast. However, the susceptibility-weighted MR Venogram technique,[1] which exploits the bulk susceptibility difference between venous blood and the surrounding tissues, is particularly effective at imaging vessels which are even smaller than the voxel dimension. The use of contrast agents is not essential and does not significantly improve image contrast. The long scan time (as much as 25 minutes) may limit standard clinical use, but it can be reduced significantly by using multiple MRI receivers and parallel imaging techniques such as Sensitivity Encoding (SENSE). Algorithms are currently being developed to fuse these 3D representations of veins with 3D mapping of cerebral function. Methods are also being developed to help reduce false positives caused by other susceptibility variations in the brain. While this scan did not immediately alter the surgical approach, the neurosurgeon discovered a possible secondary source of epileptic foci. MRV research scans sensitively detect and visualize venous abnormalities of the brain and can provide clinically useful diagnostic and anatomical information without the use of ionizing radiation. ●

References

1. Reichenbach JR, et al. JCAT 2000, 24(6).
2. Haacke M, et al. IAS 2002; 21:107-113.
3. Cox RW, *Comput Biomed Res.* 1996 Jun; 29(3):162-73.

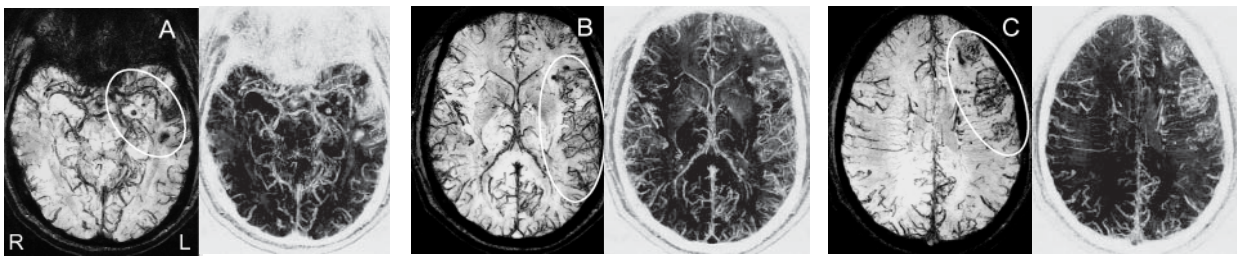

Figure 1. *MinIP Projections = 4.4 mm slabs. Images are oriented in standard radiographic presentation. Normal and reverse contrast shown at the locations mentioned above.*

RSNA'04
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Sunday, November 28 through Friday, December 3

Associated Sciences Symposia
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Monday
10:30 AM – 12:00 NOON
Fusion Imaging: Changes in the Way We See Things
Michael F. Hartshorne, MD

Tuesday
10:30 AM – 12:00 NOON
Image Guided Therapeutics
Julia Lowe, BS, RT(R)(MR)
Moderator

A) Liver Tumor Ablation, State of the Art
David S. Lu, MD

B) Endovascular Interventions
Wilfrido R. Castaneda-Zuniga, MD

C) Intraoperative MRI: Non-Imaging Issues
Stephen G. Hushek, PhD

Wednesday
10:30 AM – 12:00 NOON
Strategic Considerations in Global Teleradiology
Kathryn Canny, *Moderator*
Patricia Kroken
William G. Bradley, Jr, MD, PhD
Sanjay S. Saini, MD, MBA

AAPM/RSNA Basic Physics Lecture for the Radiologic Technologist: "Practical Aspects of Digital Radiographic Imaging"
Monday, 1:30 – 2:45 PM
S. Jeff Shepard, MS
Charles E. Willis, PhD

Refresher Courses
Sponsored by the Associated Sciences Consortium (Each Refresher Course is approved for 1.5 Category 1 credits)

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Digital Imaging: Computed Radiography and Direct Radiography
Elaine Dever, RT(R) (CAMRT) *Coordinator*
A) Computed Radiography
Charles B. Burns, MS, RT(R)
B) Direct Radiography
Kerry T. Krugh, PhD

224
Advanced Radiographic Practice
Terri L. Fauber, EdD, RT(R)(M) (AERS) *Coordinator*
Salvatore Martino, MEd, EdD
Alain Cromp

324
HIPAA: Ongoing Impacts and Re-Inventions in Radiology
Kathryn J. Canny (RBMA) *Moderator*
Patricia Kroken
Claudia Murray

424
Will JCAHO's National Patient Safety Goals Make a Difference in the Way You Practice?
Paulette B. Snoby, RN, BSN, MPH (ARNA)

524
How to Effectively Manage the Capital Asset Cycle: From Acquisition Planning to Maintenance and Replacement Strategies
Ed Mercado, MBA (SROA) *Coordinator*
Sheila M. Sferrella, MAS, RT(R)

624
The Digital Department: Its Architecture and Design
Morris A. Stein (AIA-AAH) *Coordinator*
Bill Rostenberg
Steven C. Horii, MD

724
Workforce Crisis: Strategies for Management
Barbara A. Whitefield, RT(R)(CV) (ASRT) *Moderator*
Salvatore Martino, MEd, EdD
Lynne Roy, MBA, CNMT

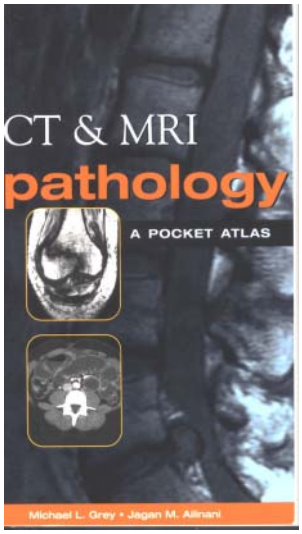
824
Your Practice Potential with Midlevels
Karen J. Finnegan, MS, RT(R)(CV) (AVIR) *Moderator*
Bill Greear, BSRT-R(CV)

Book Review

By Julie Strandt-Peay, B.S.M., R.T. (R)(MR), *Signals* Editor.

CT & MRI Pathology

Written by Michael L. Grey, M.S., R.T. (R)(MR)(CT) and Jagan M. Ailinani, M.D.
Published by McGraw-Hill, 2003
ISBN: 0-07-138040-X



This pocket sized text is offered by the authors to provide CT and MR technologists with explanations of common pathologic findings in their day to day practice. The book is divided into seven parts and includes an index and bibliography along with a helpful table of contents. Part I is the "Principles of Imaging in Computed Tomography and Magnetic Resonance Imaging." Although quite brief, this is a good overview of the two imaging modalities.

Part II covers the Central Nervous System with subheadings in both the Brain and Spine sections. The categories of pathology addressed in the brain section are neoplasm, congenital, vascular disease, infection, phakomatosis, and trauma. The spine section includes congenital, degenerative, infection, tumor, trauma, and vascular disease. Part III describes pathology of the head and neck in the following areas: congenital, tumor, sinus, and trauma.

Part IV covers pathology of the chest and mediastinum with subheadings of lungs, mediastinum, aorta, breast, and trauma. The abdomen is attended to in Part V with subheadings of liver, hepatobiliary, genitourinary, infection, trauma, and miscellaneous. Part VI covers the pelvis and Part VII deals with the musculoskeletal structures of shoulder, elbow, hand and wrist, hip, knee, ankle, and foot.

Within each listed pathology the authors furnish us with a description, the etiology and the epidemiology. They indicate the signs, symptoms, and imaging characteristics of both CT and MR. The modality of choice is noted along with the expected appearance of the pathologic condition on the specific modality. Rounding out each entry is the preferred treatment of the pathology, the prognosis for the patient, and representative images of the modality of choice, or in some cases comparing CT with MR.

This text may be extremely helpful in today's practice setting. When the order from the physician comes to the technologist there may or may not be recognition of the pathology in question or knowledge of the best way to demonstrate that disease or condition with the tools available. Many technologists work alone during an entire shift. Often technologists are working at remote locations without on site guidance from radiologists. There are also currently many situations where the CT and MR technologists are cross-trained or covering for each other. These circumstances can cause discomfort for technologists responsible for the imaging. This book will provide the technologist with readily accessible, practical information to help perform the complete examination.

Pathological conditions as well as anatomic areas are easily located in the book using the detailed index. The representative images clearly demonstrate the typical findings and the imaging techniques used in each case. When appropriate, contrast enhanced images are shown. Having this text in a lab coat pocket or near the control console may be just the additional resource needed to ensure the best imaging for the patient. The book is also available as an online educational tool at www.siu.edu/~hcp/RADS/pathology.html. ●

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SMRT Northeast Regional Seminar
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SMRT President's Regional Seminar
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