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## President's Letter

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



**SMRT** offers the best MR education in the world! I believe that statement with all my heart. As President of the SMRT, I spend a great deal of time planning and trying to think of creative ways to motivate others around me to believe as I do about the SMRT. I think I have done a pretty good job with the MR professionals that I work with but I want all MR Technologists to BELIEVE in themselves and the importance of quality continuing education. Just think, for the same price as dinner and a movie, you can be a member of the SMRT. We don't think of \$75 as a big price to pay for entertainment. Why not think of that \$75 as your ticket to the best MR education in the world! Join me and thousands of other Technologists by promoting SMRT membership.

Last year **Maureen Ainslie**, SMRT Past President, established the "Each One, Reach One" campaign. It was her goal for every SMRT member to influence one person to become an SMRT member. I would like to persuade you to set a goal for yourself to promote the SMRT to one MR technologist and make the best MR education in the world available to them as well.

The SMRT hosted five Educational Regional Seminars this fall. Regionals were held in Atlanta, Boston, New York, Charleston, and Stanford. Regionals are the best way to reach area folks that might not be able to attend an annual meeting. It also promotes the benefits of being an SMRT member to area technologists that might not otherwise know about our great society. I truly enjoyed planning the President's Regional in Charleston. The technologists that work with me were also given the opportunity to get involved. I really like it when my co-workers get excited about MR education! If you want to plan an SMRT Regional in your area, an SMRT Executive Committee member would mentor you through the process. Contact **James Stuppino**, SMRT Regionals Chair, to schedule your seminar. It is a great way to get involved with the SMRT! Thanks to all of the Regional Chairs for their successful seminars and for promoting quality MR education in their respective areas! The Regionals did promote quality MR education!

The SMRT Home Study Program is another member benefit that is truly an educational value for the price of the SMRT membership! **Anne Sawyer-Glover**, SMRT Home Studies Editor, is always seeking individuals to write questions for these premier publications. Please contact her if you are interested.

The Program Committee chaired by **Nanette Keck** and the Education Committee chaired by **John Christopher** are working extremely hard planning the upcoming meeting in Miami. The program is designed to offer a wide range of topics to attract all levels of MR technologists. You will not want to miss this educational opportunity. The SMRT "Call for Papers" deadline for abstract submission is **17 January 2005**. You can find directions and instructions online at the SMRT Website. The proffered papers and poster exhibits are one of the highlights of the meeting. I cannot wait to see what MR technologists are working on this year! Get ready to share your efforts and make that deadline of 17 January 2005 for abstract submission.

Another great member benefit and educational opportunity is the *Signals* newsletter. **Julie Strandt-Peay**, SMRT *Signals* Editor, does a wonderful job coordinating the articles and giving us that gentle reminder to keep all of us on deadlines. Without her and the SMRT office, this publication would not be possible. If you are not receiving all your *Signals* or Home Studies, please contact the SMRT office immediately. We want all members to take advantage of this member benefit.

So you see, the SMRT does offer the best MR education in the world. The SMRT strives to improve these benefits year after year. The SMRT Standing Committees are working extremely hard this year trying to improve some of our processes as well as keep up with the electronic age. We depend on many volunteer hours from officers, committee chairs, and committee members. It takes all of us working together to make a difference. I encourage you, the members, to help us make a difference by promoting the SMRT to your colleagues. We can all make an impact on the MR world together! **Each One, Reach One!** If you ever have any ideas or suggestions on ways things can be improved or if you just want to make a statement, please feel free to drop me an email. We are all in this together and we can all make a difference one member at a time.

Cindy Hipps, SMRT President  
cthipps@charter.net ●

## Update on SMRT Educational Seminars Home Studies

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



Our twenty-sixth home study issue takes us deep into a clinical MR application that originated over a decade ago: **“MR Imaging and Spectroscopy of the Prostate.”** It is only in recent years, however, that MR system manufacturers have brought to product the sequences and post-processing software to support the spectroscopy part of the examination.

As with many new clinical applications in MR, the road has been lined with limitations, controversy and lack of consensus. Despite these challenges, the innovative, the brave and the visionaries forge ahead into uncharted territory. We are very fortunate to have two of those individuals contribute their experience and wisdom to the members of the SMRT in this home study: Michael D. Macilquham, M.H.Sc., R.T., from Coburg, Victoria, Australia and Daniel B. Vigneron, Ph.D., from San Francisco, California, USA.

Mr. Macilquham and his collaborators, Jie Gong, Ph.D. and Alain M. Lavoipierre, F.R.A.Z.C.R., start us off with “The Role of Magnetic Resonance Imaging and Spectroscopy in Assessing Prostate Cancer.” This in-depth review provides a detailed description of the anatomy involved, tissue contrast, utilization of the endorectal RF coil, and the scan parameters.

Dr. Vigneron and his associates, Mark G. Swanson, Ph.D., and John Kurhanewicz, Ph.D., bring us “Advances in Prostate MR Imaging: MR Spectroscopic Imaging at 1.5T and 3.0T.” This comprehensive review gives a complete look at their experience and successes as well as what questions and limitations still remain and what opportunities the future may bring.


Many thanks to Mr. Macilquham and Dr. Vigneron for taking the time to participate in this very timely home study providing us with the latest information about MRI/S of the prostate. If you feel you need to review the basics of spectroscopy, please refer to *SMRT Educational Seminars* home study, Volume 3, Number 1, “Introduction to Spectroscopy” with articles by H. Cecil Charles, Ph.D., and Daniel Spielman, Ph.D. This back issue may be purchased through the Berkeley, California, USA office of the SMRT/ISMRM (please see information below). A very special thank you to Daniel Margolis 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. It is also a valuable addition to your resume or curriculum vitae.

Accreditation (USA) 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](http://www.ismrm.org/smrt). If you live outside of the U.S. and have interests or questions concerning accreditation within the country you reside, please contact me at [ams@g@stanford.edu](mailto:ams@g@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](mailto:smrt@ismrm.org), +1 510 841 1899).

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



The SMRT gratefully acknowledges

### MRI Devices Corporation

Waukesha, Wisconsin, USA

for their generous support of the  
2004 SMRT Educational Seminars  
home study series.

This donation demonstrates the  
consideration of MRI Devices Corporation  
for quality MR technologist education.

Contact information can be found at:  
[www.mridevices.com](http://www.mridevices.com)

## Editor's Letter

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



**G**reetings.

This is a busy time of the year for most of us and that includes the many SMRT members who have been volunteering countless hours on your behalf. President **Cindy Hipps** shows her leadership as she updates us with the activities this quarter. Editor **Anne Sawyer-Glover** brings us the information about the latest *SMRT Educational Seminars* home study which accompanies this issue of *Signals*. **John Christopher**, Education Committee Chair, invites us to participate in the Annual Meeting and along with **Nanette Keck**, Program Committee Chair, we are invited to travel to Florida in the U.S.

External Liaison **Julia Lowe** shares her experience at the recent Health Professions Network meeting. **Todd Frederick** provides us with a membership update. Regional news is brought by the co-chairs of Atlanta: **Bobbie Burrow, Carolyn Brown, Donna O'Brien**; Boston, **Carolyn Bonaceto** and **Michael Dunlap**; New York, **Cindy Comeau** and **Carol Finn**; and in Charleston, **Cindy Hipps** with the President's Regional. The next issue of *Signals* will have news about the special 2-day SMRT Regional Seminar hosted by Stanford.

We are reminded to vote for the future leadership of the SMRT. Educational material that applies to daily MR practice is presented by our columnists **William Faulkner, Michael Kean, and Frank Shellock**. Also included in this issue are the abstracts that received awards at the Annual Meeting in Kyoto. We appreciate the efforts of **Sandra Massing, Kara Baczkowski, Helle Simonsen, and David Stanley** for sharing their work.

Preliminary travel information is included for your planning. Note the participation of the SMRT at the RSNA and of course all the other listed events and activities which enable you the opportunity to learn and improve professionally. ●

## SMRT Education Committee Update

John Christopher, B.A., R.T., Chair, Education Committee



**T**he SMRT Education Committee has been hard at task. We have just completed a strategic plan for the next five to ten years. These plans are the culmination of hard work from numerous experts in their field and adhere to the objectives and goals of the organization. The Education Chair was also formally invited to attend a two-day meeting in the first week of October with the ARRT which addressed MRI testing. We all are excited about this meeting because of the hope in establishing a strong working relationship between the two organizations and elevating the recognition of the goals and endeavors of the SMRT.

The SMRT Program and Education Committees would like to announce the "Call for Papers" for the 14th Annual Meeting of the Section for the Magnetic Resonance Technologists (SMRT) in Miami Beach, Florida, USA, 6-8 May 2004. We wish to invite and welcome technologists and radiographers alike from around the world to submit abstracts for presentation in oral and poster sessions at the Annual Meeting. The deadline for the submissions is **17 January 2005**.

The SMRT is committed to the goal of providing quality education through the promotion, communication and dissemination of information regarding current and promising technological advances in the MR field to all its members. The submission of abstracts from around the world is a most effective way of relaying this information to our colleagues in the profession. Each year the quality and number of abstract submissions has increased and we look forward to this trend to continue. We had an amazing response from technologists last year which yielded a total of sixty-four (64) abstracts from seventeen (17) countries.

Abstracts for these submissions should be done electronically via the ISMRM/SMRT Website: [www.ismrm.org/smrt](http://www.ismrm.org/smrt). Detailed instructions will be posted online and the abstracts will need to be submitted according to these instructions. Topics may describe a variety of issues in clinical applications or address novel research at their institution. The abstract authors and institutions will be blinded to the reviewers and all judging will be based on a standardized scale and set criteria.

New this year will be the electronic submission of posters. This are very exciting because it's felt that this will simplify the process of submissions and judging. The successful posters will be based on the accepted criteria of the abstracts. The instructions as well as examples to assist you are posted on the SMRT Website and will need to be followed explicitly for a successful submission.

### ABSTRACT SUBMISSION GUIDELINES

Abstracts should state clearly the **Purpose** of the research or clinical study, outline the **Methods** used, summarize the **Results** of the study, and finally discuss the **Conclusions** from the results. All abstracts that are submitted and pass the criteria will be displayed as a poster or may even be nominated to be included as an oral presentation in the Annual Meeting agenda.

In completing the request for address information, it is necessary that you list the presenter's name, preferred mailing address, e-mail, and telephone/fax numbers. The submitted SMRT Abstract must be completed in its entirety or the submission will not be considered. These accepted abstracts will be published in the *SMRT Annual Meeting Syllabus*.

We all can learn from the invited speakers at these meetings as well as from each other through your submitted abstracts. Participate and be recognized for your efforts as a leader in the field. Please take this opportunity to formally write up the ideas you may have in an abstract and share your knowledge with all your international colleagues at the 14th Annual Meeting of the SMRT. We look forward to seeing you there! ●

# SMRT 14<sup>th</sup> Annual Meeting— Miami Beach, Florida, USA

6-8 MAY 2005

## “Riding the Waves of MR Excellence”

Nanette Keck, R.T., Chair, 2005 SMRT Program Committee



The SMRT is calling all MRI professionals to join us in **Riding the Waves of MR Excellence**. The meeting will be held in Miami Beach, Miami, Florida, USA, where the sun is warm, the sky is blue, and the possibilities are as endless as the waves crashing onto its white, sandy shores. A worldwide destination famous for its lively nightlife, stunning beaches, exquisite shopping, and delectable food, South Beach is jam-packed with things to do and see.

To make your stay in Miami more comfortable, the ISMRM planning committee has done an outstanding job locating area hotels that are nice, convenient to the convention center and varied in price. Please visit <http://www.ismrm.org/05/housing1.htm> to view your housing options and book your hotel reservations on line.

The SMRT 14th Annual Meeting will commence on Friday evening 6 May 2005 at 18:30 with a Poster Exhibit and Walking Tour Reception. The poster reception, one of the highlights of the meeting, provides an engaging atmosphere where attendees have the opportunity to meet the authors and ask questions about the many emerging technological advances displayed. For the added benefit of those in attendance, some of the poster authors will be asked to give a brief explanation of their work.

Following the opening events, two days of superior technologist education will be offered during which selected proffered papers will be presented. The Program Committee is pleased to announce the participation of SMRT founding fathers, Drs. John Crues and Herbert Kressel, who will be presenting talks during the program! The agenda will be submitted for Category A credit through the ASRT (credit is pending).

On Saturday morning, 7 May 2005, the didactic portion of the program will begin. At lunchtime, after the session of accredited lectures and proffered papers, the SMRT Business Meeting will take place and awards will be given to the most outstanding papers and posters submitted in both

the clinical and research arenas. The didactic portion of the meeting will then resume and the day will conclude with a cardiac forum and roundtable discussion.

Plans are underway for the first SMRT Past President's Reception on Saturday, 7 May, 19:30 at the Miami Loews Hotel. You will not want to miss this exciting opportunity to relax with your colleagues as you enjoy food, fun and entertainment, the Miami way!! You will be greeted by some of your favorite SMRT sponsors and Past Presidents.

On Sunday morning, 8 May 2005, the incoming President of the SMRT, Karen Bove-Bettis, will open the meeting by greeting all attendees. The didactic program will follow for the remainder of the day and will include a special section tailored for MR Educators.

The SMRT and ISMRM Joint Forum Presentation will be held at 14:00, Monday, 9 May 2005. Your registration for the SMRT Annual Meeting allows you to attend this SMRT/ISMRM Joint Forum Presentation. This year the forum topic will be titled “Optimizing Pulse Sequences and Protocols,” chaired by Gareth J. Barker, Ph.D., and Todd Frederick, R.T. (R)(MR). This two-hour forum will present the process of developing and optimizing pulse sequences and protocols from various perspectives: a physicist may be interested in modifying the software which controls the scanner hardware; a MRI technologist/radiographer may be concerned with the impact of parameter choices on image quality and patient compliance; for a clinician, the most important factor is likely to be whether the resulting images will allow for better patient management. The forum by design is a grand collaboration of energy and talent between the ISMRM and the SMRT which continuously promotes the highest quality of education in the MR field.

You will not want to miss this grand occasion to “**Ride the Waves of MR Excellence**” while you learn, have fun and network with one another in beautiful Miami Beach, Florida! Plan now to realize the benefits of the 2005 Annual Meeting. The Sunshine State awaits you! ●

# SMRT Preliminary Program: Riding the Waves of MR Excellence

## FRIDAY, 6 MAY 2005, 18:30-20:30

Poster Exhibit, Poster Presentations, and Poster Walking Tour Reception

## SATURDAY, 7 MAY 2005, 07:45-17:00

07:45 - 08:00 Welcome  
Cindy T. Hipps, B.H.S., R.T. (R)(MR),  
SMRT President 2004-2005

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

*Morning Moderator* – Muriel Cockburn, D.C, R.B.Sc. (Hons.) P.Gd. Cert. MRI

08:00 - 08:30 **Upper Extremity MR**  
Michael Zlatkin, M.D.

08:35 - 09:05 **Lower Extremity MR**  
John Crues, M.D.

09:10 - 09:40 **Body MRA**  
Frank Thorton, M.D.

09:40 - 09:55 Break

09:55 - 10:25 **Clinical Scanning Techniques**  
William Faulkner, B.S., R.T. (R)(MR)(CT)

10:30 - 11:10 **Proffered Papers**

11:15 - 11:45 **MR Artifacts**  
Greg Brown, R.T.

11:45 - 13:00 SMRT Business Meeting and Awards Luncheon

*Afternoon Moderator* – Robin Avison, R.T. (N)(MR), C.N.M.T.

13:00 - 13:30 **Breast Imaging**  
Todd Frederick, R.T. (R)(MR)

13:35 - 14:05 **Proffered Papers**

14:10 - 14:45 **Registry Readiness**  
Carolyn K. Roth, R.T. (R)(MR)(CT)(M)(CV)

14:45 - 15:00 Break

15:00 - 17:00 **Cardiac Forum– Roundtable Discussion**  
*Moderator*– Michael Kean, R.T.

**General Anatomy and Imaging**  
Michaela Schmidt, R.T.

**Diseases and Abnormalities**  
Peter Hunold, M.D.

**Advantages and Pitfalls of 3 Tesla Cardiac Imaging**  
William Woodward, A.R.M.R.I.T.

19:30 SMRT Past President's Reception– Miami Loews Hotel

## SUNDAY, 8 MAY 2005, 07:45-17:00

07:45 - 08:00 Welcome  
Karen Bove Bettis, R.T. (R)(MR), President 2005-2006

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

*Morning Moderator* – James J. Stuppino, B.S., R.T. (R)(MR)

08:00 - 08:30 **Neuro Imaging at T3**  
Steven Falcone, M.D.

08:35 - 09:05 **Neuro MRA**  
Elke Gizewski, M.D.

09:10 - 09:40 **HIV Dementia MRI and MRS**  
Robin Avison, R.T. (N)(MR), C.N.M.T.

09:40 - 09:55 Break

09:55 - 10:25 **Proffered Papers**

10:30 - 11:00 **Pediatric Cardiac/Abdomen**  
Michael Kean, R.T.

11:05 - 11:35 **Pediatric/Neuro**  
Susan Blaser, M.D.

11:40 - 11:55 **President's Award Proffered Paper**

11:55 - 13:00 Lunch

*Afternoon Moderator* – Carolyn Bonaceto, B.S., R.T. (R)(MR)

13:00 - 13:30 **Comprehensive Assessment of Disease with Large Anatomic Coverage**  
Silke Bosk, R.T.

13:35 - 14:05 **The Current State of Imaging in the Abdomen at 1.5T and 3T**  
Herbert Y. Kressel, M.D.

14:05 - 14:20 Break

14:20 - 15:00 **MR Safety**  
Frank Shellock, Ph.D.

15:00 - 17:00 **MR Educators Update**  
*Moderator*: Todd Frederick, R.T. (R)(MR)

**Course Accreditation**  
Luann Culbreth, R.T. (R)(MR)(QM) M.Ed.

**Teaching Methods and Techniques**  
Carolyn K. Roth, R.T. (R)(MR)(CT)(M)(CV)

**Current Issues in MR Education**  
Todd Frederick, R.T. (R)(MR)

17:00 Meeting Adjournment



# External Relations Report

Julia Lowe, B.S.R.T. (R)(MR), Chair, External Relations Committee



The Health Professions Network, (HPN) meeting took place in Salt Lake City, Utah, USA, September 30th- October 3rd. Representatives from many Allied Health disciplines attended to voice their concerns and work together to come up with solutions to some of the problems that we face in our professions today. The most common problem shared among all disciplines was the workforce shortage. There is not a shortage of students wishing to enroll into Allied Health programs, but a shortage of faculty and clinical sites with which to teach them. In fact, students are being turned away from these programs because of the vacancies in faculty positions. Some faculty positions go unfilled because graduating students can often earn more salary in their first year than the faculty members can. Solutions were discussed to remedy this dire situation by increasing the existing salaries of faculty and creating new faculty positions. Allied Health schools could apply for US federal government funding through Health Resources and Services Administration, (HRSA). HPN invited Jenny Sermas from HRSA to speak on the issue at the meeting. For more information on funding from the US federal government go to <http://www.hrsa.gov/grants/forms.htm>.

The theme for RSNA 2004 is "Radiology's Global Forum." The RSNA Associated Sciences Consortium has selected the theme "Emerging Trends, Global Perspectives" for its mini-symposia series. The SMRT is sponsoring a mini-symposium entitled "Image-Guided Therapeutics." There will be two speakers on MR: David Lu, M.D., from the University of California at Los Angeles, covering RF ablation, and Steve Hushek, Ph.D., from Norton Hospital, Louisville, Kentucky, on maintaining an MRI suite. Willie Casteneda, M.D., from Louisiana State Medical Center, Shreveport, will be speaking on endovascular therapies. If you're attending RSNA, please stop by the SMRT booth within the Associated Sciences area and meet with fellow SMRT representatives.

The President of the SMRT and the External Liaison are planning to attend the Alliance for Radiologic Excellence Meeting in Washington, D.C., in March. There, groups of the Alliance will discuss the CARE Act and develop strategies to help implement the Act. The Consumer Assurance of Radiologic Excellence Act would provide minimum education requirement guidelines and competency levels for persons performing diagnostic imaging and radiation therapy. Many groups are supporting this Act because currently the United States does not have national standards regarding who is allowed to perform diagnostic imaging. The regulations are enforced by the states and some states do not even require licensing. Another problem is the variation in education and competency requirements for licensure across the states.

The CARE Act would provide a national standard for all states and many people in Radiology are lobbying for this bill to be passed. For more information on the CARE Act go to <http://thomas.loc.gov/home/thomas.html> and search for the bill number, HR1214.

The SMRT is happy to introduce Wendy Strugnell as the new Global Relations Chair for the External Relations

Committee. Wendy is an SMRT Policy Board member and lives and works in Australia. She is welcomed to the committee and we look forward to working with her. ●

## Membership Update

Todd Frederick, R.T. (R)(MR), Chair, Membership Committee



The membership of SMRT is steadily rising with increasing participation of MR Technologists from around the world. Along with our growth in membership, we are proud of the expanding benefits provided to all who join. Please keep in mind that the value of these benefits is far more than the cost of annual dues. We thank our parent organization, the International Society for

Magnetic Resonance in Medicine (ISMRM) for their guidance and continued financial support.

The *Educational Seminars Home Studies* series continues to offer outstanding interesting and useful information on MRI specific topics. For those members who are required to obtain Continuing Education credits, these home studies provide a valuable benefit.

The SMRT is supporting many **Regional Seminars** at different locations around the U.S. As an SMRT member you receive the discounted registration for these seminars, which feature great speakers and timely topics. The SMRT is constantly looking for willing hosts in more locations around the world. The SMRT office and Regional Chair, James Stuppino, provide the host with an informational packet and support for the seminar. For more information please check the SMRT Website or contact the SMRT office. (Look for reports on recent Regional Seminars on pages 12-15).

The **2004 Annual Meeting** was a great success and the 2005 meeting in Miami Beach, Florida, USA, will be fun and exciting. This meeting is without a doubt the premier MRI technologist/radiographer educational meeting in the world. Members and potential members have the opportunity to participate in the Annual Meeting by submitting an abstract of their work for consideration of an oral or poster presentation. (See related article in this newsletter or check the web site for more information). SMRT members receive reduced registration fees to all SMRT events, including the Annual Meeting.

There are many important issues that are facing MRI technologists/radiographers, as you will read about elsewhere in this newsletter. The SMRT is recognized as the professional organization for MR technologists and is keenly involved in these issues that affect our members. We need your membership support and that of your co-workers and colleagues in order to more effectively represent MRI technologists world-wide. The SMRT will continue working toward the advancement of MR education and our profession. We thank you for your continued support. ●

## Important Reminders for SMRT Members

1. Make your vote count. It is your privilege and responsibility to vote for the future leadership of the SMRT. Ballots must be postmarked by **1 December 2004**.
2. Notify the SMRT office when your contact information changes so that you will not miss an issue of *Signals* or the *SMRT Educational Seminars* home studies.

Phone: +1 510 841 1899 Fax: +1 510 841 2340 E-mail: smrt@ismrm.org SMRT Web Page: www.ismrm.org/smrt

### LOW- AND MID-FIELD MRI

## Imaging with Contrast Agents at Mid- and Low-Field

William Faulkner, B.S., R.T. (R)(MR)(CT)

This article represents the views of its author only and does not reflect those of the International Society for Magnetic Resonance in Medicine and are not made with its authority or approval.



In the previous column I wrote about the use of gadolinium contrast agents in MRI at mid- and low-field. In this column I'd like to talk about the various pulse sequences one might use when imaging after the injection of gadolinium.

In most cases, and for the purposes of this article, we will assume we are doing a brain exam for a lesion. I believe it is also important to realize that not all lesions will "enhance" right away. I personally have seen lesions not visualized well, if at all, on the first series after the injection of gadolinium but seen on a second series. For this reason, I always recommend two series be performed after injection. I have seen some facilities perform the T2-weighted sequence after injection to allow for a bit of "delay" time prior to the post-contrast T1-weighted sequence. That would certainly seem to be a reasonable alternative.

As to the type of pulse sequences, most mid and low field system have the ability to acquire conventional spin echo (CSE), fast spin echo (FSE), T1-weighted inversion recovery (so-called "T1-FLAIR"), and spoiled gradient echo (T1-GRE).

If conventional or fast spin echo is desired, one should remember that the TR should be as low as possible without reducing the SNR to a point the image is non-diagnostic. In my experience at 0.2 T, I don't like to use a TR above 250-300 msec. Remember that T1 times are field strength dependent and as B0 is reduced, T1 times shorten. The higher the TR, the less the background tissue is saturated and therefore the less contrast between the gadolinium enhancing lesion and the background tissue. When using a lower TR, it will be obvious that you will not be allowed enough slices to cover the entire brain in one acquisition. However, increasing the TR for slices will also increase the scan time and reduce the contrast as well. Therefore, it is

better to acquire the total slices in two groups or packages at a lower TR than one group at a higher TR. Besides, remember that a 250 msec TR acquired twice is the same as a 500 msec TR acquired once and there is less cross-talk in a sequence acquired in two packages.

Some systems offer a SE pulse sequence that acquires two non-adjacent slices simultaneously. In my experience, these do not always provide the best contrast. As for the use of FSE for T1-weighting, you typically have such a severe limitation on the number of slices allowed that it is not the most slice/time efficient sequence. However, if you do use an FSE T1 sequence, you should still keep the TR very short to optimize the lesion-to-background contrast.

Newer systems may offer the ability to acquire what has become known as "T1-FLAIR." These sequences are, as the name implies, T1-weighted sequences in which the CSF is nulled. In general they can be used to produce images with very striking T1 contrast (see Figure 1, page 8). This can be particularly useful when imaging young children (less than 5 years of age) in which CSE or FSE produce sub-optimal gray/white matter contrast. For those of us that have been around MR since the mid-1980's, T1-FLAIR is basically an FSE version of the Inversion Recovery that we had on our first systems. While these sequences can, and do, produce images with much better T1 contrast than is obtainable with CSE or FSE sequences, the extra signal from white matter may reduce the lesion/background contrast.

The last type of sequence I want to address is spoiled GRE. GRE sequences can be used to obtain very heavily T1-weighted images as seen in Figure 2. TE times with GRE sequences are considerably shorter than those which can be obtained with SE sequences. This is particularly

Continued on page 8 ➔

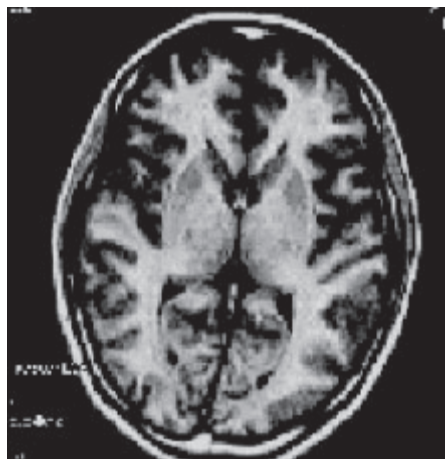


Figure 1. A T1-FLAIR image acquired at 0.2T.



Figure 2. A spoiled GRE image acquired at 0.2T.



Figure 3. Post-injection T1-FLAIR image acquired at 0.2T demonstrating a small acoustic neuroma on the left.

true given the improvements in gradient technology available even with 0.2 T systems today. Additionally, the ability to acquire spoiled GRE sequences in a 3D fashion is of further benefit given the increased SNR obtainable with a 3D acquisition. If the 3D data set is acquired using relatively isotropic voxels, the images may be reformatted into an infinite number of planes either on the scan console or PACS workstation. Figure 3 is an example of a 3D spoiled GRE sequence acquired following the injection of

gadolinium (0.1 mmol/kg). The small acoustic neuroma is easily visualized.

In summary, there are several sequences one can choose to provide T1-weighted images following the injection of gadolinium. Each has its own advantages and disadvantages. I encourage all technologists scanning at mid or low field to work with their radiologist to determine what sequence and parameters best fit their particular needs. ●

## Pediatric MRI

# MR Imaging of the Hypoxic Neonate

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

This article represents the views of its author only and does not reflect those of the International Society for Magnetic Resonance in Medicine and are not made with its authority or approval.



**H**ypoxic- Ischemic Encephalopathy (HIE) is a term used to describe infants that have sustained fetal distress prior to delivery (bradycardia, tachycardia), who have low Apgar scores requiring resuscitation at birth and show neurological signs in the first few days after birth.

Depending upon the type of insult the patient may have quite obvious clinical signs such as decreased conscious state (Grade 111), seizures, lack of tone (Grade 11) or subtle signs like irritability, and lack of interest in feeding (Grade 1). Asphyxia (implies hypoxemia or cerebral ischemia or a combination of both) complicates 3-5/1000 live births with approximately 1/1000 live births being diagnosed with HIE. HIE is the most important perinatal cause of neurological morbidity (mortality 10-60% depending upon severity and source of data) and neurological impairment (approx 25%). The effects of HIE are thought to be the combined effects of two events (a) the initial insult and

(b) a secondary and potentially more devastating secondary energy failure occurring 18 – 36 hrs after the initial insult.

The primary patho-physiological disturbance in HIE is a reduction in oxygen supply to the brain that can have devastating consequences on normal cerebral metabolism, these changes are the result of two distinct mechanisms:

1. Hypoxemia – diminished amount of oxygen in the blood.
2. Ischemia – diminished perfusion. Hypoperfusion is the dominant pathological process and results in a deprivation of oxygen and glucose. From the literature it would appear that reperfusion of the hypoperfused areas of the brain may have the most deleterious consequences for babies with HIE.

Ultrasound and CT have historically been the modality of choice for imaging babies with HIE due to the relative ease of access to the facilities. Many authors (Rutherford, Barkovich, Inder, Huppi, Neal) have for many years advocated the clinical utility of early MR examinations in these patients.

Continued on page 9 ➡



The role of MRI in these patients is the evaluation of the existence, extent and subsequent evolution of these lesions. The appearances on MR are dependent upon:

- (a) severity of the injury and subsequent intervention;
- (b) duration of the event;
- (c) regional maturity of the brain at the time of insult;
- (d) timing of the MR examination;
- (e) MR sequences and parameters used.

The timing of the initial MR is important as the absence of certain characteristic MR features (T1, T2, and DWI) may lead to a period of false negativity within the first 24hrs after the insult. Most authors have the opinion that MR within the first 24-36 hrs should only be undertaken if crucial end of treatment decisions are to be made. The ideal examination period is 3-7 days post insult.

A comprehensive MR examination (quantitative and qualitative) is crucial for the examination of infants with suspected HIE. Qualitative sequences such as axial T2 and T1 are essential to depict the early changes associated with both T1 and T2 shortening evident in the early phases of the process and T1/T2 prolongation in the later phases. These early changes may represent haemorrhage, presence of lipids associated with myelin breakdown, myelin clumping or dystrophic calcification.

The sequences of choice will reflect the equipment available and the preference of the reporting radiologists. In general the examination at 1.5T should combine T1 weighted FSE (TR 1300 , TE 10) or Inversion Recovery (TR 4500, TE 30, TI 600-800 ) and T2 ( TR > 3500, TE 140 ). There are many options for the T2-weighted sequence but most authors tend to agree that FSE sequences do provide the necessary diagnostic accuracy. Some authors still advocate use of dual TE sequence (60/140) for the evaluation of these patients feeling that the short TE provides greater diagnostic accuracy in the early phases. T2-weighted FLAIR would seem to add very little diagnostic benefit in this disease process.

Axial imaging is preferred due to its ability to depict the changes within the internal capsule especially the posterior limb. Additional planes such as sagittal and coronal may be added for clarification. High spatial resolution is critical for the evaluation of the infant brain; at our institution slice thickness of 2.5 – 3 mm is mandatory and a minimum inplane resolution of 0.06mm x 0.06mm is judged to be a balance between SNR and acceptable scan times.

Diffusion weighted imaging (DWI) with calculation of apparent diffusion coefficients ( ADC) are performed on all neonatal cases with a B value of 1000 and 2000. Changes to the examination parameters for the higher B value are necessary to account for the lower SNR. Using a standard Quadrature transmit receive head coil our parameters are TR 10,000, TE 112, 127, 4mm/0.5mm, 2-4 Nex 22-24 slices. Approximately 5% of babies with HIE will have hemorrhagic lesions that will be evident on the B=0 image in the diffusion sequence.

Regional variation of ADC values will occur due to maturation of cerebral structures but in general a reduction in ADC values of approximately 30% will occur due to the effects

of the ischemic insult. All sites performing ADC calculations on infants will need to have a minimum number of regional areas of interest that they routinely perform on all these babies. A basic set would include bilateral comparison of Frontal White Matter ( FWM) Anterior Limb Internal Capsule (ALIC) Thalamus, Putamen, Posterior Limb of the Internal Capsule ( PLIC) Anterior/Posterior Corpus Callosum, Cortical Gray, and Brainstem.

MR Spectroscopy is now an accepted component of the comprehensive examination of babies with HIE. Early research concentrated on the use of <sup>31</sup>P in the evaluation of the early stages of HIE primarily to understand the consequences and timing of the secondary energy failure. Current work revolves around the clinical utility of proton spectroscopy (single voxel (SV), chemical shift (CSI, 2D, and 3D). There are several issues that users need to be aware of when electing to perform MRS in neonates– changing chemical composition of the myelinating brain, regional variation of metabolites, presence of lactate in the preterm infant, and the appearance of Propylene Glycol doublet at 1.15ppm which is often confused for lactate. The parameters chosen will reflect the type of system, coil used and voxel size. As with conventional imaging the SNR of the MRS examination will be affected by voxel size, and parameter optimisation is necessary to maintain good quality spectra. The TE chosen will reflect the metabolites that the clinicians and radiologists choose to quantify– PRESS 30ms is predominantly used with a TE 144 used to invert lactate if necessary. Most sites have a standard set of reference spectra locals that they use for these babies– most authors consider the minimum locations to be basal ganglia (BG) Posterior White Matter (PWM) and cortical GM. Post processing quantification with software such as LC Model is crucial to gain the maximum information from the spectra.

Future advances in understanding HIE will come with further utilisation of <sup>31</sup>P MRS, Sodium Imaging, and greater diversity of multiple B value diffusion techniques in a clinically acceptable scan time that have evolved at 3 Tesla. Early and sequential follow-up MR is seen to be so important in neonatal care that MR systems are being planned for many neonatal units. ●

### Suggested Reading

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## Magnetic Resonance Imaging: Information for Patients\*

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



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**Message to MR Users: This information is provided as a template for use by MRI facilities. As such, an MRI facility is free to utilize this information, as needed, and to modify, adapt, or otherwise change the content relative to the specific facility and conditions.**

### What is magnetic resonance imaging (MRI)?

MRI, or magnetic resonance imaging, is a means of “seeing” inside of the body in order for doctors to find certain diseases or abnormal conditions. MRI does not rely on the type of radiation (i.e., ionizing radiation) used for an x-ray or computed tomography (CT). The MRI examination requires specialized equipment that uses a powerful, constant magnetic field, rapidly changing local magnetic fields, radiofrequency energy, and dedicated equipment including a powerful computer to create very clear pictures of internal body structures.

During the MRI examination, the patient is placed within the MR system or “scanner.” The powerful, constant magnetic field aligns a tiny fraction of subatomic particles called protons that are present in most of the body’s tissues. Radiofrequency energy is applied to cause these protons to produce signals that are picked up by a receiver within the scanner. The signals are specially characterized using the rapidly changing, local magnetic field and computer-processed to produce images of the body part of interest.

### What is MRI used for?

MRI has become the preferred procedure for diagnosing a large number of potential problems in many different parts of the body. In general, MRI creates pictures that can show differences between healthy and unhealthy tissue. Doctors use MRI to examine the brain, spine, joints (e.g., knee, shoulder, wrist, and ankle), abdomen, pelvic region, breast, blood vessels, heart and other body parts.

### Is MRI safe?

To date, over 150 million patients have had MRI examinations. MRI has been shown to be extremely safe as long as proper safety precautions are taken. In general, the MRI procedure produces no pain and causes no known short-term or long-term tissue damage of any kind.

The powerful magnetic field of the scanner can attract certain metallic objects that are “ferromagnetic,” causing them to move suddenly and with great force towards the center of the MR system. This may pose a risk to the patient or anyone in the path of the object. Therefore, great care is taken to prevent ferromagnetic objects from entering the MR system room. It is vital that you remove metallic objects in advance of an MRI examination, including watches, jewelry, and items of clothing that have metallic threads or fasteners.

The MRI facility has a screening procedure that, when carefully followed, will ensure that the MRI technologist and radiologist knows about the presence of metallic implants and materials so that special precautions can be taken (see below). In some unusual cases, the examination may be canceled because of concern related to a particular implant or device. For example, if an MRI is ordered, it may be cancelled if the patient has a ferromagnetic aneurysm clip because of the risk of dislodging the clip from the blood vessel. Also, the magnetic field of the scanner can damage an external hearing aid or cause a heart pacemaker to malfunction. If you have a bullet, shrapnel, or similar metallic fragment in your body there is a potential risk that it could change position, possibly causing injury.

### How to prepare for the MRI examination.

There’s no special preparation necessary for the MRI examination. Unless your doctor specifically requests that you not eat or drink anything before the exam, there are no food or drink restrictions. Continue to take any medication prescribed by your doctor unless otherwise directed.

You won’t be allowed to wear anything metallic during the MRI examination, so it would be best to leave watches, jewelry or anything made from metal at home. Even some cosmetics contain small amounts of metals, so it is best to not wear make-up.

In order to prevent metallic objects from being attracted by the powerful magnet of the MR system, you may receive a gown to wear during your examination. Items that need to be removed before entering the MR system room include:

- Purse, wallet, money clip, credit cards, other cards with magnetic strips
- Electronic devices such as beepers or cellular phones
- Hearing aids
- Metallic jewelry, watches
- Pens, paper clips, keys, nail clippers, coins
- Hair barrettes, hairpins
- Any article of clothing that has a metallic zipper, buttons, snaps, hooks, under-wires, or metallic threads
- Shoes, belt buckles, safety pins

Before the MRI procedure, you will be asked to fill out a screening form asking about anything that might create a health risk or interfere with the examination. You will also

\* Developed in conjunction with the Safety Committee of the International Society for Magnetic Resonance in Medicine.

undergo an interview by a member of the MRI facility to ensure that you understand the questions on the form. Even if you have undergone an MRI procedure before at this or another facility, you will still be asked to complete an MRI screening form.

Examples of items or things that may create a health hazard or other problem during an MRI exam include:

- Pacemaker
- Implantable cardioverter defibrillator (ICD)
- Neurostimulator
- Aneurysm clip
- Metallic implant
- Implanted drug infusion device
- Foreign metal objects, especially if in or near the eye
- Shrapnel or bullet
- Permanent cosmetics or tattoos
- Dentures/teeth with magnetic keepers
- Other implants that involve magnets
- Medication patch (i.e., transdermal patch) that contains metallic foil

Check with the MRI technologist or radiologist at the MRI facility if you have questions or concerns about any implanted object or health condition that could impact the MRI procedure. This is particularly important if you have undergone surgery involving the brain, ear, eye, heart, or blood vessels.

**Important Note:** If you are pregnant or think that you could be pregnant, you must notify your physician and the radiologist or the MRI technologist at the MRI facility prior to the MRI procedure.

Before entering the MR system room, any friend or relative that might be allowed to accompany you will be asked questions to ensure that he or she may safely enter the room and will likewise be instructed to remove all metallic objects. Additionally, this individual will need to fill out a screening form.

### What is the MRI examination like?

The MRI examination is performed in a special room that houses the MR system or “scanner.” You will be escorted into the room by a staff member of the MRI facility and asked to lie down on a comfortably padded table that gently glides you into the scanner.

In order to prepare for the MRI examination, you may be required to wear earplugs or headphones to protect your hearing because, when certain scanners operate, they may produce loud noises. These loud noises are normal and should not worry you.

For some MRI studies, a contrast agent called “gadolinium” may be injected into a vein to help obtain a clearer picture of the body part that is undergoing examination. At some point during the procedure, a nurse or technologist will slide the table out of the scanner to inject the contrast agent. This is typically done through a small needle connected to an intravenous line that is placed in an arm or hand vein. A saline solution will drip through the intravenous line to prevent clotting until the contrast agent is injected at some point during the exam. Unlike contrast

agents used in x-ray studies, MRI contrast agents do not contain iodine and, therefore, rarely cause allergic reactions or other problems.

The most important thing for you to do is to relax and remain still. Most MRI exams take between 15 to 45 minutes to complete depending on the body part imaged and how many images are needed, although some may take 60-minutes or longer. You’ll be told ahead of time how long your scan is expected to take.

You will be asked to remain perfectly still during the time the imaging takes place, but between sequences some minor movement may be allowed. The MRI Technologist will advise you, accordingly.

When the MRI procedure begins, you may breathe normally, however, for certain examinations it may be necessary for you to hold your breath for a short period of time.

During your MRI examination, the MR system operator will be able to speak to you, hear you, and observe you at all times. Consult the MR system operator if you have any questions or feel anything unusual.

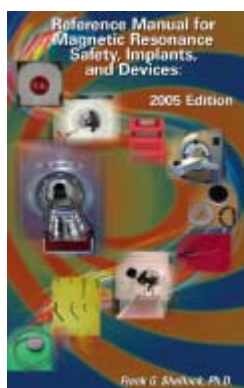
When the MRI procedure is over, you may be asked to wait until the images are examined to determine if more images are needed. After the scan, you have no restrictions and can go about your normal activities.

Once the entire MRI examination is completed, the pictures will be reviewed by a radiologist, a specially-trained physician who is able to interpret the images for your doctor. The radiologist will send your doctor a report. You should contact your doctor to go over your results and discuss your next step.

### DISCLAIMER

This information is provided for the sole purpose of educating you as to the basics of the MRI examination. You should rely on your physician, radiologist, or MRI technologist for specific information about your own examination. ●

#### The Reference Manual for Magnetic Resonance Safety, Implants and Devices: 2005 Edition



is an indispensable textbook for radiologists, MRI technologists, and facility managers. This annually-revised, internationally acclaimed textbook series is a comprehensive resource that includes up-to-date guidelines and recommendations for MRI safety based on the latest peer-reviewed publications. This manual is also the only comprehensive source of information for implants and devices tested for safety in the MRI environment. “The List” now contains tabulated information for more than 1,300 implants and devices, including data for over 300 objects tested at 3.0-Tesla or higher.

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## Report on the SMRT Southeast Regional Seminar

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

The Atlanta Local Chapter of the SMRT hosted the Southeast Regional Seminar on September 18<sup>th</sup>, 2004, at St. Joseph's Hospital Auditorium in Atlanta, Georgia. This was our eighth annual local chapter meeting and in spite of hurricane Ivan, we were pleased to have 94 attendees.

The educational presentations began with Dr. Salil Patel, a cardiologist from our area, delivering an update on Cardiac Imaging. Dr. Patel was followed by an abdominal radiologist, also from the area, Dr. Diego Martin. Dr. Martin provided a great overview of abdominal techniques as well as some of the new imaging protocols for the small bowel and urogram studies.

Robin Greene-Avison, SMRT Fellow and Past President, was the next speaker. She explained how MR imaging and spectroscopy plays a role in the treatment of HIV dementia patients. Her talk was well received by the audience.

Carolyn Roth, SMRT Fellow and Past President, was the last lecturer before lunch. As always, she offered a wonderful refresher course in MR Physics that everyone seemed to appreciate. For her many years of participation in the educational efforts of the Atlanta Local Chapter, Ms. Roth received special recognition. The surprise singing telegram left the otherwise effervescent speaker speechless!

Everyone enjoyed the opportunity to have lunch together in the food court. This time was well used for the attendees to network and share MR experiences with each other. There were also displays from several vendors that offered information and a chance to investigate MR related products.

Ms. Roth began the afternoon session with Part 2 of the Physics review. Rita Clemons followed with a timely topic that discussed "Changing Gears" and dealing with the components of a career change.

Sharing his experiences with open MRI, James Stuppino was the next speaker. Mr. Stuppino was the program chair for the SMRT Annual Meeting held in Japan this past May. Wrapping up the didactic activities of the day was the current SMRT President, Cindy Hipps. She conveyed an excellent overview of Musculoskeletal MRI.

The Atlanta Local Chapter has always had superb support from its local vendors. This year, we would especially like to thank all of our sponsors for their help and wonderful contributions they provided to us. We are so grateful and very overwhelmed by all of the wonderful door prizes we received. We would also like to thank St. Joseph's Hospital for hosting this meeting, and to our speakers and attendees who all helped make our meeting a great success.

As always Donna O'Brien, Carolyn Brown and Bobbie Burrow enjoyed co-chairing the meeting. This has now become an annual event. Mark your calendars for 2005. The date is always the 3rd Saturday in September. We hope to see you here next year. ●

### SMRT Southeast Regional Educational Seminar Sponsors:

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Northside Hospital  
Philips Medical Systems  
Siemens Medical Solutions



Attendees share thoughts during the break.



Registration is a busy time in Atlanta.

# Report on Northeast Regional Seminar

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



The faculty and staff of Beth Israel Deaconess Medical Center in Boston were pleased to host their first SMRT Northeast Regional Seminar on Saturday 2 October 2004. The meeting was a huge success due to the generous support of Beth Israel Deaconess Medical Center, Berlex Imaging, Bracco, ONI, Medrad, Inc., Invivo/MRI Devices, GE Healthcare, Siemens Medical Solutions, and the Institute for Magnetic Resonance Safety, Education, and Research. The co-chairs for the seminar were Carolyn Bonaceto, R.T. and Michael Dunlap, R.T. Robert Marquis, R.T., who moderated the session, and Regina Garland, who helped coordinate the event, assisted them.



The morning began with a continental breakfast and registration. After opening remarks by Carolyn, Rob introduced Neil M. Rofsky, M.D. Dr. Rofsky, who is the MRI Physician Director at BIDMC, is world renowned for his many contributions to advances in current abdominal imaging techniques. Dr. Rofsky presented a fascinating discussion entitled "Advances in Body Imaging at 3T." BIDMC is installing its third General Electric 3T system, and all will be used for clinical imaging. Dr. Rofsky displayed high quality images that prove that the challenges body imaging presents at high field strengths, such as RF power deposition and increased imaging artifacts, can be easily overcome.



Following Dr. Rofsky was Herbert Y. Kressel, M.D., Professor and Chairman of Radiology at BIDMC. Dr. Kressel, who has served as the president, CEO, and CMO of the medical center, is also Past President of the International Society for Magnetic Resonance in Medicine (ISMRM). He presented an informative lecture on "Analytical Approach to MRI Purchasing Decisions," offering a frame-work for making purchasing decisions based on clearly identified critical criteria, such as product quality, reliability, and service as well as compatibility with existing systems. Conference attendees appreciated that Dr. Kressel acknowledged the need for their input when evaluating equipment for purchase.



After a brief morning break, Rob introduced Deborah Levine, M.D., co-director of ultrasound imaging at BIDMC. Dr. Levine's topic, "Fetal Magnetic Resonance Imaging" was captivating. She presented remarkable examples of both maternal and fetal imaging, comparing ultrasound images with MRI. Her lecture addressed many applications for MRI when imaging the pregnant patient including safety considerations, contrast use, adnexal masses and fibroids, pelvimetry, placental evaluations, and MRI's role in the workup of abdominal pain. Dr. Levine continued her discussion by

identifying techniques for fetal imaging using MRI, highlighting its advantages when evaluating the fetal brain and spine. With continued improvements in MRI system performance, she feels that fetal CNS imaging is one of the most exciting areas of growth for this modality. Although less cost effective than sonography, which remains the gold standard, MRI holds great potential for broader use for fetal imaging in the future.

A lunch break, which was generously supported by Berlex, was held on the tenth floor of the Shapiro Clinical Center. The boardroom location offered stunning views of the city on a beautiful fall day. Everyone enjoyed the opportunity to stretch their legs, visit, and renew professional contacts.

Immediately following lunch, Stephen J. Powers, R.T. tackled "Data Manipulation in MRI." Steve discussed different types of K-space filling, their advantages and disadvantages, and appropriate applications. A topic that is often difficult to understand was made clearer by Steve's excellent presentation.



Steve was followed by another intensely technical discussion by Daniel Sodickson, M.D., Ph.D., who is credited with introducing the concept of parallel imaging to the MRI community. Dr. Sodickson offered a lecture entitled "Parallel Imaging Today and Tomorrow," discussing the fundamentals of parallel imaging and its uses. Aided by several cleverly animated slides, he took the audience through the planning and execution of a MRI examination using parallel imaging, including tips for successful clinical applications. Dr. Sodickson concluded with some insights on the future of parallel imaging and the research he performs at BIDMC.

During the final break, thanks to the generosity of Dr. Frank Shellock, 15 copies of the Reference Manual for Magnetic Resonance Safety, Implants & Devices, 2004 Edition, were raffled off to conference attendees.



Next to present was Robert Lenkinski, Ph.D., whose discussion of Breast MR Spectroscopy was particularly encouraging. Because time of diagnosis is the best indicator for cancer prognosis, new imaging methods capable of early detection are urgently sought. Dr. Lenkinski demonstrated the improved sensitivity and specificity MRI and MRS offer clinicians. Using MR spectra of breast lesions, Dr. Lenkinski emphasized the diagnosis value of choline peaks as a marker of early indications for malignancy. He showed how these concepts apply to other pathologies, such as prostate cancer and malignant brain lesions, highlighting his research as the Director of Advanced MRI/S at BIDMC.

Continued on page 14 ➡



To complete the session, Boris Nicolas Bloch, M.D., presented “*MRI of the Prostate.*” Dr. Bloch, an MRI research fellow at BIDMC, captivated attendees with amazing examples of image quality attainable at 3T using an endorectal coil. He suggested protocols for proper patient preparation and optimum image quality. Displaying images acquired at

3T, he demonstrated how higher field strengths offer increased signal-to-noise and superior spatial resolution with half the voxel size as compared to 1.5T. Dr. Bloch expressed confidence that using 3T MRI with an endorectal coil will continue improve staging accuracy in prostate cancer, thereby improving the quality and efficacy of treatment. ●

## Report on the SMRT New York City Regional Meeting

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

The SMRT Northeast Regional was held in the “*Big Apple*” on Saturday, 25 September 2004 at New York Presbyterian Hospital & Milstein Hospital, New York, New York. It was a great day of education for all technologists who attended! First off, I have to sincerely thank my co-chair Carol Finn for assisting me in securing a meeting room for this Regional as the New York Presbyterian Hospital Radiology Department graciously donated the room for this meeting. The program was approved for eight category A credits by the ASRT.



After a very busy morning registration time, the meeting promptly started with William Faulkner, SMRT Fellow and Past President. He did a wonderful job covering new pulse sequences, which was important information for all the attendees. He always does a fantastic job in making difficult concepts very fun to learn! His presentation set the stage for the rest of the agenda. Next up was Frank Macaluso, Research Operations Manager from Mt. Sinai Medical Center. Frank’s topic was “*MRI of Congenital Heart Disease*” and he presented a vast array of cases that were quite complicated. He did an excellent job in keeping the group’s interest. Following was Gary McNeal, from Siemens Medical Solutions. Gary covered some of the most recent advances in cardiac MRI, which was very practical information for everyone. Right before lunch Frank Shellock, Ph.D., gave the attendees a very thorough review and update on MRI safety. His presentation was very much appreciated and it generated lots of questions, which were all addressed. Dr. Shellock provided his 2004 Safety book to all of the attendees, which was a big hit and he donated one of his safety videotapes, which was raffled off during the afternoon break.

After lunch the afternoon session started with Dave Stanley from GE Healthcare. Dave clarified questions about the capabilities of 3T scanners. His expertise with this subject was very evident by the excellent content of his presentation. Our first physician presenter was Steven Wolff, M.D., Ph.D., from Advanced Cardiovascular Imaging, New York, New York. He quizzed the group on their knowledge of vascular MRA. His presentation focused on key issues involved in acquiring vascular MRA images. Dr. Wolff answered lots of questions as advancements in vascular MRA certainly keep technologists on their toes! Next was Dr. Lawrence Tanenbaum, M.D., from Edison, New Jersey, who presented some fabulous cases demonstrating new scanning techniques that have been introduced by vendors within the last year. His energetic style and candor was very much enjoyed by everyone.

To close out the day was SMRT representative James Stuppino. Jim definitely kept the group on track with his very interesting presentation on Spectroscopy. He even shared some of his cultural experience from the SMRT Annual Meeting that was held in Kyoto, Japan. At the end of his presentation he encouraged people to become more involved with SMRT by hosting a regional seminar.

We had tremendous sponsor support for this meeting. I would like to especially thank Berlex Laboratories, Inc., GE Healthcare, Institute for Magnetic Resonance Safety, Education and Research, Medrad, ONI Medical Systems, Inc., Siemens Medical Solutions, and Tyco Healthcare Mallinckrodt. The SMRT would also like to thank all the speakers who took time out of their busy schedules to participate and all of the attendees for spending their Saturday learning and advancing their knowledge. Lastly, I need to thank Jennifer Olson at the ISMRM office for her guidance with organizing this meeting as she truly makes it a very rewarding experience! ●

# Report on the SMRT President's Regional Seminar in Charleston, South Carolina, USA

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

The SMRT President's Regional hosted by SMRT President, Cindy Higgs, was held at the Thurmond Gazes, Solomon Conference Room at The Medical University of South Carolina on 9 October



2004. The evaluations of the 50 plus MRI technologists in attendance indicate that the meeting was a huge success. The program was started with a lecture on MRI of the Breast given by Anne Sawyer-Glover from Stanford, California. She gave up-to-date information concerning the MR imaging of the breast. Dr. Rollings from Savannah Cardiology was next and gave an inspiring presentation on Cardiac MRI. He was rated "speaker extraordinaire" and was able to incorporate the latest in music in his presentation. Body MRI was the next lecture given by Dr. Steven Lowe from Greenville Radiology. His tips and suggestions were well received by the attendees. Geoff West from West Physics Consulting presented the group with the facts for ACR Quality Control and made everything appear easy to understand.

After breaking for lunch sponsored by Tyco Healthcare Mallinckrodt, Dr. Frank Shellock gave an MRI Safety Update and, as usual, was a big hit with the meeting attendees. "Advanced MR and Future Applications" was the lecture title for Carolyn Roth. With her usual exciting speaker style, she was able to show some of the exams we all might do five years down the road! Maureen Ainslie gave an exceptional and informative talk about Spectroscopy



Past President, Maureen Ainslie and speaker, Carolyn Kaut-Roth.



Didactic information is well received by the MR technologists in attendance.

and Clinical Trials that was sure to provide the most recent information concerning this topic. Last but not least, Dr. Ron Cowley gave one of the best "Head and Neck Neuro-Anatomy" lectures I have ever seen. The others agreed as well. The meeting participants received 9 hours of Category A credit from the ASRT for attending the meeting.

It is hard to put into words the gratitude I have for the sponsors that provided all the financial means for this program. As a special thank you to the sponsors and speakers, "An Oyster Roast" was held on Saturday evening after the meeting to honor the following: Berlex Laboratories, Inc., Bracco, GE Healthcare, Greenville Hospital System, Greenville Radiology, PA, Institute for Magnetic Resonance Safety, Education and Research, Jannx Medical Consultants, Magmedix, MRI Devices Corporation, ONI Medical Systems, Inc., Palmetto Health-Easley, SpanAmerica, Tyco Healthcare Mallinckrodt, and West Physics Consulting. It was fun and quite entertaining to watch some of those that have never cracked an oyster open by hand!

Thanks to the Medical University of South Carolina for hosting the SMRT President's Regional Educational Seminar.

I would like to extend a personal thank you to the committee that worked tireless days and nights to make sure



From left to right: SMRT members Bobbie Burrow, Wendy Porter, and Melonee Elrod. Far right: Debbie Hames, Greenville Radiology/Easley MRI Clerical Coordinator and assistant to Cindy Higgs.

the meeting was a success. Bobbie, Debbie, Wendy and Melonee made all the little details come together as they provided that special touch to their duties. They are all such great friends. Dawn Czarnecki did a great job dispersing the door prizes too! Of course, I must mention the SMRT Office and Jennifer Olson, who always makes sure the meeting is a success. Thanks to Hamp Culler and his crew for the special harbor tour that was enjoyed by the out of town speakers and guests. The city lights of Charleston will never be forgotten! ●



2004 3rd Place Proffered Paper Oral Presentation, Research Focus–

## Assessment of Myocardial Viability using Contrast-Enhanced MRI– Comparison of Gd-DTPA and Gd-BOPTA

Sandra Massing, Thomas Schlosser, Jörg Barkhausen

Department of Diagnostic and Interventional Radiology, University Hospital Essen, Essen, Germany

### Introduction

Contrast-enhanced magnetic resonance imaging (MRI) allows differentiation between reversible and irreversible ischemic injury. Much effort has been spent to find both optimum dose and time point for data acquisition after contrast injection. However, the effect of different contrast agents on contrast to noise ratios in damaged and normal myocardium has not been assessed yet.

### Purpose

To compare Gadopentetate Dimeglumine (Gd-DTPA) and Gadobenate Dimeglumine (Gd-BOPTA) for the assessment of myocardial viability in patients with chronic myocardial infarction (MI).

### Methods

Fifteen patients with a history of MI were examined on two separate occasions with each agent (Gd-BOPTA, MultiHance®, Bracco S.p.A., Milan, Italy and Gd-DTPA Magnevist®, Schering AG, Berlin, Germany) in randomised order. The minimum time between both examinations was 48h. Following the acquisition of cine MRI images to assess myocardial function, contrast enhanced MR imaging was performed. 15 min after injection of 0.2 mmol/kg contrast agent late enhancement MR imaging was performed using a segmented inversion-recovery gradient-echo sequence (TR: 8 msec; TE: 4.3 msec; flip angle: 25 degrees). Signal intensities (SI) and contrast-to-noise-ratio values were measured in equally sized regions of interest (ROI) in the non-infarcted myocardium, the infarcted myocardium, and the left ventricular cavity (LVC). Depiction of the infarction area was visually assessed for both agents. Comparative analysis was performed, statistical significance was established at  $p < 0.05$ .

### Results

Comparative analysis between measurements in the Gd-BOPTA data sets 15 minutes after injection and those obtained with Gd-DTPA demonstrated significantly higher SI in the infarcted

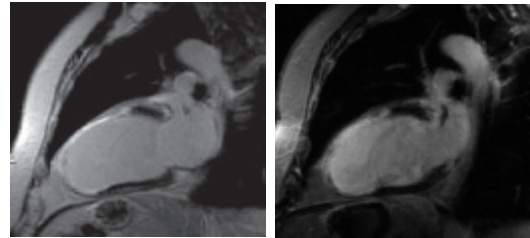


Figure 1. Contrast-enhanced MRI images in a patient after a large myocardial infarction in LAD territory using Gd-DTPA (left) and Gd-BOPTA (right).

myocardium and the LVC for Gd-BOPTA (SI infarct  $58.6 \pm 10.9$  vs.  $45.2 \pm 13.3$ ,  $p < 0.02$ ; SILVC  $69.8 \pm 18.5$  vs.  $41.4 \pm 9.0$ ,  $p < 0.01$ ). The SIs in the non-infarcted myocardium were not significantly different (SI noninfarct  $12.7 \pm 7.2$  (Gd-BOPTA) vs.  $9.3 \pm 6.7$  (Gd-DTPA)). CNR infarct-noninfarct was significantly higher in the Gd-BOPTA data sets compared to Gd-DTPA ( $48.6 \pm 14.2$  vs.  $34.5 \pm 15.4$ ,  $p < 0.04$ ), whereas CNR infarct-LVC was significantly higher in Gd-DTPA enhanced images ( $5.2 \pm 8.5$  vs.  $-10.9 \pm 17.9$ ,  $p < 0.02$ ). However, the infarction zone was visually better seen with Gd-DTPA (Figure 1).

### Conclusion

Fifteen minutes after contrast injection CNR between infarcted and normal myocardium was higher in the Gd-BOPTA data sets, but Gd-DTPA permitted better differentiation between the infarcted myocardium and the LV cavity. This may help to detect subendocardial infarction, because 15 minutes after injection of Gd-BOPTA the LV cavity was still isointense or slightly hyperintense compared to the infarcted tissue. In order to distinguish between the infarcted tissue and the LVC, late-enhancement studies using Gd-BOPTA might benefit from a longer delay after contrast injection. However, to improve workflow in cardiac MRI more rapid clearing contrast agents appear advantageous. ●



2004 3rd Place Proffered Paper, Poster Presentation– Research Focus

## A New Look into Kicking a Football: An Investigation of Muscle Activity Using MRI

Kara Baczkowski<sup>1</sup>, Paul Marks<sup>1</sup>, Michal Schneider-Kolsky<sup>2</sup>, Morry Silberstein<sup>2</sup>

<sup>1</sup>Department of Radiology, The Avenue Private Hospital, The Avenue, Windsor, Victoria, Australia, <sup>2</sup>Department of Medical Imaging & Radiation Science, Monash University–Clayton Campus, Wellington Road, Clayton, Victoria, Australia

### Purpose

Australian Rules Football is a sport that demands athletic ability, agility and stamina from players. A mix of aerobic and anaerobic running, kicking and jumping is required and players regularly succumb to injuries. Lower limb injuries are commonly seen, with hamstring, groin and knee injuries dominating the list at the elite level. The drop punt kick is the most important means of progressing the ball around the field and is considered to be responsible for some of these injuries. Electromyography (EMG) has previously been used to investigate which muscles are activated during the drop punt kick, but this method of analysis has provided limited results. Recent studies indicate that Magnetic Resonance Imaging (MRI) can be used to display the physiological changes brought

about in exercised muscles, and studies indicate that MRI not only provides accurate information on muscle activity, which is graded depending on exercise intensity, but also provides a detailed anatomical analysis of soft tissues, such as muscles, that is lacking in EMG tests. The purpose of this study was to develop a non-invasive method of identifying individual thigh muscles involved in kicking a football.

### Method

Ten adult males of variable levels of fitness were recruited to participate in this study. A 1.5T G.E. MRI scanner was used to obtain axial images of both legs, using the body coil, before and



immediately after a set exercise routine. Participants were positioned supine, feet first with a centre point localised midline at the level of the upper thigh. A fast STIR sequence was used to scan from the superior level of the femoral head to the distal third of the femur (26 slices in total). Scans were performed prior to exercise to establish individual baseline signal intensity readings for each participant. Following the baseline scans, each participant was asked to kick an Australian Rules football 100 times into a net as quickly and with as much force as possible. Participants then returned to the scan table within two minutes after kicking, and the same region of interest was re-scanned. Fourteen thigh muscles were examined on both the kicking leg and the stance leg. A paired t-test was used to compare the mean signal intensity change of each muscle before and after exercise.

## Results

Significant increases in signal intensities ( $p < 0.05$ ), ranging between 5% and 59%, were identified in muscles of both the

kicking and the stance legs of all participants. The gracilis and the semitendinosus muscles displayed the greatest changes in the kicking and the stance leg respectively (59% and 58% respectively). The mean overall increase in signal intensity was highest in participants not involved in regular exercise. This technique also demonstrated which muscles were either not at all or minimally activated during kicking a football.

## Conclusions

The MRI technique described above is useful for analyzing the muscles activated during kicking an Australian Rules football. This non-invasive approach provides a detailed analysis of anatomy and offers a unique insight into patterns of muscle activation during a set exercise protocol. This technique could be utilized in the future for analysis and development of training and rehabilitation protocols of footballers, and could be expanded upon for use in other sports. ●



2004 3rd Place Proffered Paper Oral Presentation, Clinical Focus-

## Pathogenesis of Corticospinal Tract Degeneration in ALS Patients by Diffusion Tensor Imaging

H. Simonsen<sup>1</sup>, S. Rosenbaum<sup>1</sup>, M. Karlsborg<sup>2</sup>, M.R. Wiegell<sup>3</sup>, O. Gredal<sup>2</sup>

<sup>1</sup>Danish Research Center for Magnetic Resonance; Hvidovre University Hospital and <sup>2</sup>Department of Neurology, Bispebjerg University Hospital, Copenhagen, Denmark; <sup>3</sup>Massachusetts General Hospital, NMR Center, Boston, Massachusetts, USA

## Introduction

Amyotrophic Lateral Sclerosis (ALS) is a severe progressive disease of unknown etiology and pathogenesis affecting the motor neurones especially of the spinal cord. Studies have indicated involvement of neurones in the motor cortex and the axons in the corticospinal tract (CST) in the cerebrum. However, it is not known if the involvement is due to anterograde degeneration starting in the soma of the motor neurones spreading to the axons of the CST (“dying forward”) or retrograde degeneration starting in the peripheral axons spreading centrally towards the soma of the motor neurones (“dying backward”). The aim of the study was to investigate if the pathogenesis of ALS occurred via a “dying forward” or “dying backward” degenerative mechanism could be determined applying diffusion tensor imaging (DTI) in patients suffering from ALS.

## Subjects

Eleven patients (8 males and 3 females, 32-76 years, mean age 59 years) and 11 age-matched healthy controls (33-73 years, mean age 60 years) underwent the MRI protocol. Patients (=9) with clinical signs of upper motor neurone (UMN) involvement were pooled for further evaluation and compared to patients (=2) with only signs of lower motor neurone (LMN) involvement and healthy controls.

## Methods

All scans were performed on a 1.5T Siemens Magnetom Vision whole body scanner (Siemens Medical Systems, Erlangen, Germany). The scanner was equipped with an EPI-booster. DT imaging of the whole brain were acquired with 24-30 axial slices for each person. A SE-DWI-EPI sequence, with TE 101ms, TR=4 ms, matrix 128 x128, FOV 230 mm, slice thickness 5 mm and a

b-factor of 550 s/mm<sup>2</sup> was used. One null image and six diffusion weighted images were obtained, with the diffusion encoding directed along the following axes: (1,1,0), (1,0,1), (0,1,1), (-1,1,0), (-1,0,1) and (0,-1,1). For post processing, the images were aligned and the DTI eigensystem was calculated. The images were color-coded according to the diffusion directions in space. The fractional anisotropy index (FA) and the apparent diffusion coefficient (ADC) was calculated from the three principal eigenvalues. The ADC and the FA were obtained in those regions, which clearly included the descending CST, visualised from radiata, through the posterior limbs of the internal capsule down to pons identified on PDW- and T2W-images (TR/TE: 3000/20/80, slice thickness 5 mm, matrix 256 x256) aligned to the DTI images. We subdivided the CST into three different regions according to the course in the (cranial-caudal): corona radiata, internal capsule and pons. Two sample t-tests with equal or unequal variances was used to compare the two patient groups with the control group in every region. Statistical tests were performed at a 5% level of significance.

## Results

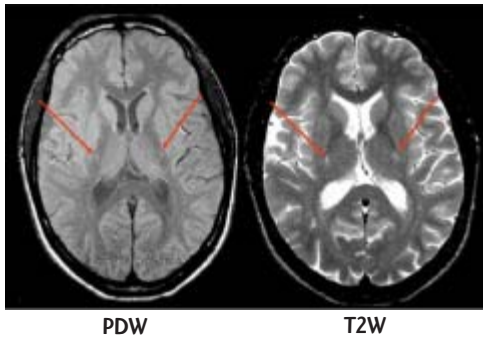
At the pons level the ADC in the UMN group, 0.79 mm<sup>2</sup>/sec ( $\times 10^{-3}$ )  $\pm$  0.07 (SD), was higher than in the healthy controls, 0.76 mm<sup>2</sup>/sec ( $\times 10^{-3}$ )  $\pm$  0.05 (SD),  $p=0.029$ . The FA in pons in both patient groups, 0.58 mm<sup>2</sup>/sec ( $\times 10^{-3}$ )  $\pm$  0.06 (SD) in the UMN group and 0.56 ( $\times 10^{-3}$ )  $\pm$  0.03 (SD) in the LMN group were significantly lower than in the healthy control group, 0.61 ( $\times 10^{-3}$ )  $\pm$  0.06 (SD),  $p=0.023$  and  $p=0.001$ . The ADC in the CST in the internal capsule was significantly higher in the UMN group, 0.80 ( $\times 10^{-3}$ )  $\pm$  0.07 (SD), than in the LMN group, 0.76 ( $\times 10^{-3}$ )  $\pm$  0.03 (SD),  $p=0.006$  and the healthy controls group 0.80 ( $\times 10^{-3}$ )  $\pm$  0.07 (SD),  $p=0.005$  (see Table 1 and 2).

Table 1. ADC of the corticospinal tract (CST) in corona radiata, internal capsule and pons.

	ADC cor.rad. mm <sup>2</sup> /sec	ADC int.caps mm <sup>2</sup> /sec	ADC pons mm <sup>2</sup> /sec
UMN (n=9)	0.84 0.10	0.80 0.07*	0.79 0.07*
LMN (n=2)	0.80 0.02	0.76 0.03	0.78 0.06
Control (n=11)	0.81 0.08	0.76 0.07	0.76 0.05

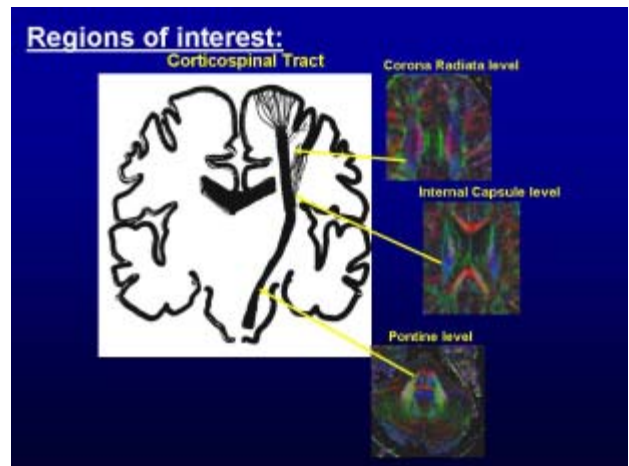
Table 2. FA of the corticospinal tract (CST) in corona radiata, internal capsule and pons.

	FA cor.rad. mm <sup>2</sup> /sec	FA int.caps mm <sup>2</sup> /sec	FA pons mm <sup>2</sup> /sec
UMN (n=9)	0.43 0.09	0.61 0.07	0.58 0.06*
LMN (n=2)	0.47 0.06	0.61 0.10	0.56 0.03*
Control (n=11)	0.42 0.10	0.64 0.08	0.61 0.06



**Discussion**

This study showed that ADC in the UMN group was increased in CST at the level of pons the internal capsule but not in the more cranial corona radiata. FA was only decreased at the level of pons in CST. This indicates that the pathogenesis of ALS with UMN



involvement is a retrograde degeneration starting in the axons “dying backwards” towards the soma of neurons in the motor cortex. ●



2004 3rd Place Proffered Paper, Poster Presentation—Clinical Focus

**Time-resolved Renal MRA with TRICKS**

David Stanley<sup>1</sup> and James Glockner<sup>2</sup>

<sup>1</sup>Applied Science Laboratory, GE Medical Systems, Milwaukee, Wisconsin, USA; <sup>2</sup>Mayo Clinic, Rochester, Minnesota, USA

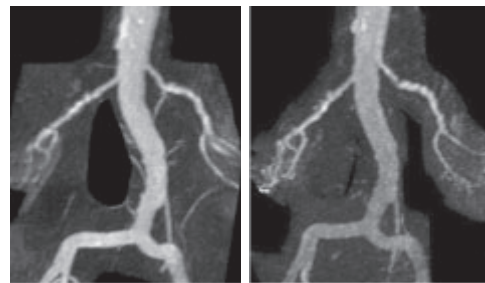
**Purpose**

Contrast-enhanced renal MRA is a widely accepted and effective technique for the evaluation of renal artery disease. Many studies have demonstrated high sensitivity and specificity for the detection of significant renal artery stenosis. However, renal MRA does have limitations such as spatial resolution and temporal resolution. During suspended respiration, the aorta and renal arteries may move significantly during the 20-25 seconds typically required for renal MRA. This motion blurring may hinder detection of subtle lesions as well as limit visualization of segmental arteries.

TRICKS (Time-Resolved Imaging of Contrast Kinetics) is a dynamic technique in which a high resolution mask is acquired first, followed by a series of temporally resolved 3D acquisitions where the peripheral views in k-space are sampled less frequently and shared between frames. By sharing the outer views of k-space, a multi-phase acquisition with high spatial resolution can be obtained in approximately the same time as the conventional renal MRA acquisition.

**Method**

Conventional 3D contrast-enhanced MRA consisted of a 3D fast SPGR sequence with the following parameters: TR/TE 3.6/1.2 msec, 35 degrees flip angle, ±62.5 kHz bandwidth, 26 cm FOV, 256x192 matrix, 0.75 NEX, 1.6 mm slice thickness, 30-40 slices, and the average scan time was 22 seconds. 0.1 mm/kg of contrast was administered using a power injector at 3 ml/s, with a scan delay determined by a prior test bolus. TRICKS MRA was performed approximately 3-5 minutes following the conventional MRA using 12-15 ml contrast injected at 3 ml/s. A mask acquisition was initially acquired (25s); after a brief pause, 5 temporally resolved 3D volumes were obtained following contrast administration. The TR, TE, flip angle and FOV remained the same for the two scans. The following parameters were changed: ±83 kHz bandwidth, 2.2 mm section thickness, 32 sections, 256x256 matrix, 0.5 NEX. The effective temporal resolution of the sequence was 3.6 seconds.



**Figure 1.** MIP images from conventional renal MRA (left) and TRICKS MRA (right) with temporal resolution of 3.6 seconds. Note the improved visualization of FMD lesions in the left main renal artery using the time-resolved technique as well as improved visualization of segmental renal arteries.

Collapsed images from each time were reviewed and the optimal time frame was selected. This 3D data set was then reconstructed in the usual manner and compared with the conventional sequence.

**Purpose**

TRICKS images were diagnostic in all cases (8 cases). In one patient, fibromuscular dysplasia (FMD) was seen involving both renal arteries. The TRICKS images more clearly depicted the lesions, particularly in the left renal artery (Figure 1). Visualization of segmental arteries was slightly improved in all patients using the TRICKS techniques.

The CE MRA and TRICKS were compared and ranked on the bases of SNR, spatial resolution, artifacts, renal artery visualization and overall image quality on a scale of 1-5, with 1 being poor and 5 being very high or excellent. CE MRA had higher scores than TRICKS for SNR, and was slightly preferred for overall image quality. TRICKS were preferred for renal artery visualization. Spatial resolution and artifact scores were not significantly different.

**Purpose**

Preliminary results using a time-resolved renal MRA sequence are promising. The TRICKS technique allows for excellent temporal resolution while still preserving relatively high spatial resolution, and the combination of these elements may improve visualization of FMD as well as atherosclerotic lesions in segmental arteries. ●

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# Associated Sciences: Emergent Trends - Global Perspectives

## Registration Information

Advance registration for the RSNA Scientific Assembly ends November 12, 2004. Onsite registration begins at 12:00 NOON on Saturday, November 27, at McCormick Place. RSNA shuttle bus service to McCormick Place will be available beginning at 11:00 AM on Saturday. Registration is required to attend the Associated Sciences Programs.

Onsite registration fees are \$100.00 higher than advance registration fees.

Advance registration and housing information can be found on the RSNA Web site at [www.rsna.org](http://www.rsna.org).

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## Associated Sciences Program at RSNA 2004

Sunday, November 28 through Friday, December 3

### Associated Sciences Symposia

(Each Symposium is approved for 1.5 Category 1 credits)

#### 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 Crompt

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)  
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Sheila M. Sferrella, MAS, RT(R)

624

#### The Digital Department: Its Architecture and Design

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724

#### Workforce Crisis: Strategies for Management

Barbara A. Whitefield, RT(R)(CV)  
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