Signals

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NEWSLETTER OF THE SECTION FOR MAGNETIC RESONANCE TECHNOLOGISTS

IN THIS ISSUE

President's Letter

John A. Koveleski, R.T. (R)(MR)

With 2003 underway, I'd like to give the membership an update since the last quarterly issue of *Signals*. For those of you that attended the RSNA, I'd like to thank you for stopping by the Associated Sciences booth and introducing yourself. SMRT Policy Board members helped staff the booth and participated as faculty in Associated Sciences Courses.

The SMRT Policy Board meets face-to-face twice each year– at our Annual Meeting and also during RSNA in Chicago. The Executive Committee holds teleconferences more frequently to discuss pending issues. During our Policy Board meeting in Chicago, **Maureen Hood**, External Relations chair, stated that the JRCERT would like the SMRT to nominate two educators, two technologists, and two physicists. As you are probably aware, the JRCERT has finalized the accreditation of MR educational programs, which takes effect the first of this year. The JRCERT will review the credentials of each of the above educators and select one of each. The SMRT appreciates the JRCERT's willingness to allow us to participate in this endeavor.

Annual Meeting Program Chair, **Laurian Rohoman**, has finalized the program for our Annual Meeting in Toronto in May. If you haven't already done so, please make plans to join us. Laurian and her committee have produced a program that looks very exciting and offers a variety of topics and speakers. Toronto is a great city, and we look forward to convening there in the Spring.

Education Chair, **Julie Lowe**, will be busy along with her committee reviewing the abstracts that have been submitted for the Toronto meeting. The SMRT recognizes the best abstract with the "President's Award" and also offers prizes for both oral and poster presentations, which include both a clinical or research focused topic.

Nominations/Awards Chair, **Heidi Berns,** put together an excellent ballot for the Policy Board elections and also the other awards that the SMRT offers. These people will take office and/or be recognized during our business meeting in Toronto, which will be held during lunch on Saturday. The attendees are encouraged to remain and see the inner actions of the SMRT Business Meeting.

The SMRT recently purchased the ARRT mailing list for all 10,000+ registered American MR technologists. The purpose of this was to introduce ourselves to those who are unfamiliar with the SMRT. I'm happy to report that the interest in membership is on the rise due to this mailing. The SMRT offers you so much for such a reasonable price. It will also fulfill all of your ARRT CE requirements.

In addition to *Signals* on the SMRT Website, we now offer a *Highlight Your Site* section. Many thanks go to **Maureen Ainslie**, President-Elect, for her hard work. We'd like our membership to tell us a bit about their site. To kick things off, I agreed to tell a little about my site. If you haven't seen it already, check it out on our website.

If you aren't reading this online, please visit our website at www.ismrm.org/smrt. As always, your questions and comments are welcomed. E-mail smrt@ismrm.org or you can e-mail me directly at jak3264@aol.com. See you in Toronto! ●

Editor's Letter

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

Greetings.

This issue of *Signals* is packed with information for you! First of all, congratulations to those newly elected! President **John Koveleski** keeps us up to date, and **Kelly Baron** shares the latest home study. A preview to the Annual Meeting can be found in articles by **Laurian Rohoman**, **Julie Lowe**, and **Nanette Keck**. Following a review process, the President's Award paper was selected and is printed here for you. Our regular columns from **Bill Faulkner** on "Low- and Mid-Field MRI" and **Frank Shellock** on "MR Safety" contain important information for you and your site. Newly elected Policy Board Member **Denise Davis** contributes an article relating to the use of other nuclei in MR Imaging. The 2002 3rd Place Clinical Focus Poster abstract by **Catherine M. Callahan** is incorporated in this issue. **Muriel Cockburn** reviews a new book that may be helpful to you and your site. Local Chapter news is brought to us by **Bobbie Burrow**. Be sure to check out the *"Highlight Your Site"* feature on the SMRT Website and as always note the calendar of upcoming events.

Note: Because the SMRT wants you to receive all of your member benefit materials, be certain to let the office in Berkeley know if your mailing or electronic address has changed. ●

Update on
SMRT Educational Seminars

Kelly D. Baron B.S., R.T. (R)(MR), Chair, SMRT Publications Committee

The latest issue of the home study series is *"Directions in MRA of the Abdominal Aorta and Lower Extremities,"* using the work of ISMRM member Thomas M. Grist, M.D. MR angiography has gone through many changes over the past several years. This home study will teach you about different techniques and methods that you can try at your own sites. You will learn how to perform the studies, including patient set up and parameters. The pathology covered includes aneurysm, occlusive disease, and the evaluation of grafts. Lower extremity MR angiography is described with contrast and non-contrast methods, moving table techniques and the accuracy of diagnosis. Future directions are also discussed.

Thank you to all of the question authors and reviewers; without all of your volunteer hours these home study issues would not happen. And to all of you who support this continuing educational project, thank you. Future issues planned this year are anatomy of the knee, imaging of soft tissue neck, and a cardiac update.

We will continue to attempt to provide you with twelve approved credits per year in the field of MR. Please feel free to contact me with any suggestions or comments, or if you would like to participate in putting together a home study, e-mail: baron4mri@woh.rr.com ●

Election Results

Heidi Berns, M.S., R.T. (R)(MR), SMRT Past-President, 2002-2003 Awards Committee Chair

The election results have been tabulated and we are pleased to announce the new Policy Board members, the results of the Presidential election, as well as the Crues-Kressel Award winner.

First, the SMRT would like to thank those who accepted their nominations to be a candidate for all of the above-mentioned positions. It is truly an honor to be nominated for any of these categories, and our sincere appreciation goes out to all whose names appeared on the ballot. The SMRT would also like to thank the membership for voting. This is an organization which truly appreciates input from all of its members.

The SMRT is pleased to announce the following:

President-Elect:
Cindy Hipps, Greenville, South Carolina, USA

Policy Board:
Gregory Brown, Adelaide, Australia
Andrew Cooper, Nottingham, England, UK
Denise Davis, Pittsburgh, Pennsylvania, USA
Todd Frederick, Dallas, Texas, USA
Judy Wood, Chicago, Illinois, USA

Crues-Kressel Award:
Gregory Brown, Adelaide, Australia


Cindy Hipps


Gregory Brown


Andrew Cooper


Denise Davis


Todd Frederick


Judy Wood

The newly elected President-Elect and Policy Board Members will take office at the SMRT 12th Annual Meeting to be held 9-11 May 2003 at the Metro Toronto Convention Centre, Toronto, Ontario, Canada. The Crues-Kressel Award will be awarded at the SMRT Business Meeting during lunch on Saturday, 10 May.

Please make plans to join us for our 12th Annual Meeting this spring. More information can be found at the SMRT Website at http://www.ismrm.org/smrt. ●

"Excellence Through World-Class Education"
SMRT 12th Annual Meeting

Laurian Rohoman, A.C.R., R.T. (R)(MR), 2003 Program Committee Chair

The New Year has arrived and the 12th Annual Meeting of the SMRT is just three months away. Hopefully you are making plans to attend. The theme of the 2003 meeting is *"Excellence Through World-Class Education."* The Program Committee has designed a program that will meet the needs of all MR technologists in both clinical practice as well as in the research area. The meeting faculty includes clinicians, physicists, and magnetic resonance technologists, who will present topics that relate to current and advanced MR technology as well as to practical applications. The goal of the SMRT is to advance the continuing education for MRI/S technologists worldwide. This program will allow you to enhance your knowledge in the field of MRI.

The meeting will begin with a *Poster Exhibit and Walking Tour Reception* on Friday evening, 9 May 2003 at 18:30. This will be a great opportunity to meet and share experiences with fellow technologists from around the world in a relaxed and informal atmosphere. The poster authors will be present to answer any questions and share their expertise with you.

The didactic portion of the meeting will start off early Saturday morning, 10 May at 07:45 with opening remarks from both the President and the Program Chair. Please see the program on page 4. Selected proffered papers will be presented as part of the program. We hope that many of you have taken the opportunity to be an active part of the meeting by submitting your abstracts. The annual SMRT Business Meeting will take place during the lunch hour on Saturday. This is an excellent way to learn more about the SMRT and to become actively involved in the organization. After the Business Meeting, awards will be presented for the best oral and poster presentations. Special Recognition Awards will also be presented at this time.

Following last year's success, the *Safety Forum* will again be THE hot topic at the SMRT Annual Meeting to be held on Sunday, 11 May during the lunch hour. Dr. Frank Shellock will be moderating the forum and we have invited expert panelists William Faulkner, Dr. Emanuel Kanal, and Dr. Robert Herfkens, who will discuss current safety issues. There will be ample time for questions from the audience during the forum.

After two days of extensive education, why not take some time to enjoy the hospitality and the many attractions the city of Toronto has to offer. One of the major attractions is the CN tower, the largest free-standing structure in the world, and right next door is the Skydome, home to the popular Toronto Blue Jays baseball team. Baseball fans, you may even catch a game if the team is in town. A walking tour through Chinatown and the European style Kensington Market is almost a must for Toronto visitors. Toronto is a city filled with boutiques, restaurants, and cafés. For those of you who enjoy shopping there is the Underground City, an 11 km subterranean walkway lined with shops, restaurants, banks, and theatres.

Don't miss the spectacular Niagara Falls and Niagara region, only an hour's drive from Toronto. You don't want to miss out on this exceptional educational experience and wonderful vacation opportunity. Please make plans now to attend the SMRT 12th Annual Meeting.

We look forward to seeing you in Toronto.

"Excellence Through World-Class Education"

SMRT 12th Annual Meeting Program

The meeting will commence with a Poster Exhibit and Walking Tour Reception on Friday evening, 9 May at 18:30.

Saturday, 10 May 2003, 07:45-17:30

07:45-08:00
Welcome and Announcements

08:00-09:00
Basics of Functional Neuro Imaging
Anne Sawyer-Glover, B.S., R.T.(R)(MR)

09:00-10:00
Cardiac Imaging
Naeem Merchant, M.D.

10:15-11:15
Physics: New Pulse Sequences
William Faulkner, B.S., R.T.(R)(MR)(CT)

11:15-11:45
Proffered Papers

1st Place Award– Clinical Focus
Mercedes Pereyra, R.T.
"Quantitative Assessment of Global LV Function Using Sensitivity Encoding (SENSE) Accelerated Balanced FFE"

2nd Place Award– Clinical Focus
Claudio Arena, R.T. (CT)(MR)
"Robust Small Field-of-View, High Resolution Contrast Enhanced MRA (CE-MRA) of Renal Arteries Using Sensitivity Encoding in Two Dimensions (2D-SENSE)"

3rd Place Award– Clinical Focus
Eva Wembacher, R.T.
"Comparison of Different Techniques for MR-Colonography"

11:45-13:30
SMRT Business Meeting and Awards Luncheon

13:30-14:30
Breast Imaging
Petrina Causer, M.D.

14:30-15:30
Pulse Sequences and Protocols in MSK
Garry Gold, M.D.

15:45-16:00
Proffered Paper

President's Award–
Eva Wembacher, R.T.
"Combined Small and Large Bowel MR Imaging in Patients with Inflammatory Bowel Disease"

16:00-17:00
Pre- and Postnatal Pediatric Neuromaging: How and Why
Erin Simon, M.D.

17:00-17:30
Assessment of Gastrointestinal Disorders
Silke Bosk, R.T. and Thomas Lauenstein, M.D.

17:30 Adjournment

Sunday, 11 May 2003, 07:45-17:30

07:45-08:00
Welcome and Announcements

08:00-09:00
Functional MRI: Past, Present, and Future
Peter Bandettini, Ph.D.

09:00-10:00
Stroke Imaging
Richard Frayne, Ph.D.

10:15-11:15
Contrast Enhanced MR of the Abdomen: Contrast Agents, Techniques, and Findings
Richard Semelka, M.D.

11:15-13:15
MRI Safety Forum and Luncheon
Frank Shellock, Ph.D., Moderator

13:15-13:45
Proffered Papers

1st Place Award– Research Focus
Heather Ducie, R.T. (MR)
"Analysis of Perfusion MRI Data in Patients with Severe Cerebrovascular Disease"

2nd Place (Tie) Award– Research Focus
Jane Francis, D.C.R., (R) (DNM)
"Cardiovascular Magnetic Resonance in the Pre- and Post-Operative Assessment of Patients Undergoing Left Ventricular Reduction Surgery"

2nd Place (Tie) Award– Research Focus
Wendy Strugnell, B.Sc., R.T.
"Cardiac MRI Analysis of RV Function– A New Approach"

13:45-14:45
Talking Sense and Non-Sense in Parallel Imaging
Donald W. McRobbie, Ph.D.

15:00-16:00

MRI of the Female Pelvis: Emphasis on Technique
Eric Outwater, M.D.

16:00-17:00

Why 3T?
David W. Stanley, B.S., R.T. (R)(MR)

17:00-17:30
Proffered Papers
"Improvement in the Selection of Stereotactic Biopsy Target in Intracerebral Gliomas Using T2* Perfusion," *Filip De Ridder, R.T.*

"The Preoperative Assessment of Mitral Regurgitation by Magnetic Resonance Imaging: A Series of 6 Patients," *Cindy Comeau, B.S., R.T. (N)(MR)*

"Dynamic Contrast Enhanced Bilateral Breast Technique," *David Stanley, B.S., R.T. (R)(MR)*

17:30 Adjournment

SMRT Forum at the 11th Annual Meeting of the ISMRM:

MR Purchase Decisions

Nanette Keck, R.T.,
2003 SMRT Forum Organizer

We would like to invite all SMRT members to attend the **SMRT Forum on MR Purchase Decisions** being held right after our SMRT weekend. There will be no extra charge to attend if you have paid for the weekend course. We will be getting information not only from well-known technologists in our field, but also from radiologists who have been involved in setting up hospital-based or free-standing centers. This will be a great chance to get feed-back from all the experts within a two-hour period.

Monday, 12 May, 14:00 - 16:00

Educational Objectives

Upon completion of this course, participants should be able to:

- Describe the various types of MR systems available today;
- List the major differences between systems;
- Describe the advantages and disadvantages of each;
- Explain how various system components impact MR image quality;
- Explain the system requirements for various types of MR procedures.

Program Topics and Speakers

14:00 **Analytic Approach to Equipment, Finances, Compatibility, Site Preparation, PACs, and Delivery**
Herbert Y. Kressel, M.D.

14:30 **Dedicated vs. Whole Body Scanning**
William Faulkner, B.S., R.T. (R)(MR)(CT)

15:00 **1.0/1.5 T vs. Low-field**
James J. Stuppino, B.S., R.T. (R)(MR)

15:30 **1.5T vs. 3T**
Gary H. Glover, Ph.D.

16:00 Adjournment

2003 President's Award–

Combined Small and Large Bowel MR Imaging in Patients with Inflammatory Bowel Disease

Eva Wembacher, Silke Bosk, Thomas C. Lauenstein, Stefan G. Rühm, and Jörg F. Debatin,
Department of Diagnostic and Interventional Radiology, University Hospital Essen, Essen, Germany

Purpose

MRI of the small bowel has become an established method for the assessment of inflammatory bowel diseases. A good distension of the intestine is mandatory for small bowel imaging. The mere oral administration of water without intubation is non-invasive and well accepted. Unfortunately, this procedure is often associated with a rapid resorption of water in the small bowel, which diminishes bowel distension. Certain additives can inhibit water resorption. Recently, a solution containing mannitol and locust bean gum has been proposed as an oral contrast agent for small bowel MRI. Inflammatory bowel disease can affect both small and large bowel. Thus, aim of this study was to evaluate the practicability of the mentioned contrast combination for small bowel MRI combined with large bowel imaging in patients with inflammatory bowel disease.

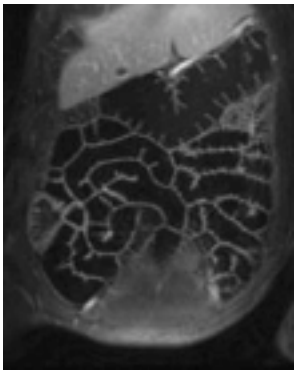

Figure 1. *Coronal source image of 3D GRE T1w sequence acquired 75 seconds after the i.v. application of paramagnetic contrast. The combination of applying both rectal and oral contrast allows a visualization of both the small and large bowel.*

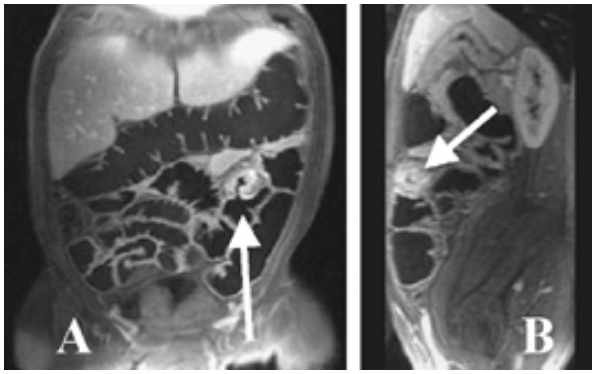

Figure 2. *By means of the combined small and large bowel imaging protocol, additional inflammatory lesions could be detected in the proximal small bowel (arrow).*

Method

Twenty-eight patients (17 women, 11 men) with suspected acute inflammatory bowel disease were included in this study. MRI was performed following an eight-hour fast. To provide sufficient small bowel distension, patients ingested 1500ml of a solution containing 2.5% mannitol and 0.2% locust bean gum (LBG). Ingestion started 45 minutes prior to the MR examination. For an enhanced gastric emptying, 50mg Erythromycin were administered intravenously. In addition to the small bowel visualization, the colon was rectally filled with 1000 ml of tap water. MR examinations were performed on a 1.5 T system (Magnetom Sonata, Siemens). To minimize bowel peristalsis and to reduce colonic spasms, 20 mg of scopolamine were administered intravenously. Paramagnetic contrast was intravenously administered at a dosage of 0.2 mmol/kg and a flow rate of 3ml/s. Before and after a delay of 75 seconds, a T1-weighted 3D gradient echo data set was acquired over 22 seconds in a single breathhold. The examination was performed in supine position. All patients underwent a conventional colonoscopy within 3 days of the MR examination. MR results were compared to endoscopic and respective histologic findings. Besides, MR image quality was assessed regarding bowel distension using a 5-point scale (1=poor distension, 5=excellent distension).

Results

The oral ingestion of mannitol and LBG resulted in a good or excellent small bowel distension in 26 out of 28 patients (Figure 1). Two patients were not able to ingest the entire 1500ml of the contrast solution. Thus, only a fair small bowel distension could be achieved. The rectal application of water allowed an assessment of the colonic wall in all 26 patients. Endoscopy and histology rated 13 patients to suffer from acute inflammatory bowel disease (Crohn's disease n=10, ulcerative colitis n=3). Post-inflammatory lesions, such as fibrotic strictures of the terminal ileum were seen in four patients. MRI confirmed acute inflammation in 12 out of 13 patients as well as post-inflammatory strictures in four patients. For the differentiation between acute and chronic lesions, the contrast enhancement of the bowel wall played a key role: while an increased enhancement compared to the non-affected bowel wall was determined in acute lesions, chronic lesions did not show a significantly increased contrast uptake. Furthermore, MRI detected inflammatory lesions in the jejunum and proximal ileum in three additional patients (Figure 2).

Conclusions

Small bowel MRI in conjunction with the oral application of mannitol and locust bean gum is practicable. The additional rectal administration of water allows the visualization of both small and large bowel. Hence, MRI is an appropriate tool for the diagnosis and follow-up of patients with inflammatory bowel diseases. Major advantages of the proposed MR concept are related to its non-invasive character as well as to the potential to visualize parts of the small bowel that cannot be reached by endoscopy. ●

Education Committee Report

Julia Lowe, B.S., R.T. (R)(MR), 2002- 2003 Education Committee Chair

With the new year of 2003 also came January 17th, the final day for submission of abstracts to the SMRT for the 12th Annual Meeting in Toronto. It has been a pleasure to review new and interesting abstracts that will be shared by fellow technologists from around the world. In the past, technologists have asked during the poster tour about how abstracts and posters are judged. I would like to take this opportunity to explain the procedure that the SMRT follows in scoring abstracts.

Abstract Judging

The Education Committee Chair begins recruiting abstract reviewers at the end of the year before the abstract deadline. Members of the Policy Board are typically selected for this task. In fact, any active member of the SMRT that shows an interest in being a reviewer may be selected. An average of ten individuals make up the reviewing committee, with at least two alternate reviewers. Alternate reviewers score abstracts that have been submitted by reviewers. In this case, the reviewer would mark "Conflict" in the score box and an alternate would be assigned to score it.

The SMRT office prepares a packet and mails it to each reviewer. This preparation includes blinding the reviewer to author, institution and preference (oral vs. poster). The packet is confidential, it includes all the abstracts submitted, and guidelines on how to score. The reviewers are instructed to score on basis of content, presentation, and original work.

A numbering system of 1-10 is used to score the technologists' work, with 1 being outstanding and 10 being unacceptable. The reviewer sends the packet back to the SMRT office once all abstracts have been scored so that they may be correlated and tabulated with all the other reviewers' scores. Once all the reviewers have scored an individual abstract, the numbers are added up for one averaged score. The final scores are given to the Program Committee, the Education Committee and the President of the SMRT. The abstract with the best overall score is given the President's Award. Also 1st, 2nd, and 3rd place awards are given in the clinical and research categories for oral presentation. The Program Chair integrates the winning abstracts into the Annual Program agenda to be presented to the meeting attendees.

The reviewers for the 2003 abstract submissions are: Education Chair, Julie Lowe, Silke Bosk, Karen Bove Bettis, Cindy Comeau, Cindy Hipps, John Koveleski, Scott M. Kurdilla, Adam Stevens, Julie Strandt-Peay, Jim Stuppino, and Rhonda Walcarius. Thank you to everyone for volunteering your time for this important function of the Education Committee.

A poster reception will be held on Friday evening at the Annual Meeting in Toronto. Reviewers and meeting attendees have the opportunity to view the posters and speak with the presenters. This is a festive occasion that includes education, refreshments, and the opportunity to network with others in the MR field. The original abstract reviewers will judge the posters, and these scores will be combined with the first abstract scores to determine the winners in each category. The winners of the 1st, 2nd, and 3rd place clinical and research posters will be presented awards at the award ceremony on Saturday afternoon.

The members of the SMRT greatly appreciate the technologists that submit abstracts and all of the hard work associated with this accomplishment. Great care is taken in judging the abstracts. Meeting attendees, reviewers, and technologists that write abstracts all benefit from this event. These abstracts have been an extremely important part of past Annual Meetings and we look forward to the abstracts for the 2003 Meeting in Toronto! ●

External Relations Report

Maureen Hood, B.S.N., R.N., R.T. (R)(MR), External Relations Committee Chair

SMRT is a member of the Associated Sciences Consortium of the RSNA. The SMRT had two speakers participating this year, Carolyn "Candi" Kaut Roth, R.T. (R)(MR), gave a refresher course talk on Continuity of Care, and Julie Strandt-Peay, B.S.M., R.T. (R)(MR), spoke in the Process of Managing Outcomes refresher course. The Associated Sciences Consortium finally has an easy-to-see brochure on the opening RSNA meeting web page http://www.rsna.org/rsna/images/associated_sciences.pdf. *"Fusion Imaging – the New Horizon,"* was the theme for this year's mini-symposium at the RSNA, which focused on CT/PET combination scanners. The next planning meeting is set for February 2003.

The SMRT staffed the RSNA Associated Sciences booth as we do every year. The SMRT is seen as one of the groups that consistently has people present on behalf of our society every year. Many people came by throughout the week to say hi and to ask questions. So remember, if you attend the RSNA next year, stop by the booth and say hi. It's a great chance to meet new people and see old friends. Also announced at RSNA: the "Minnies." AuntMinnie.com awarded our very own Bill Faulkner as the "Most Effective Radiologic Technologist Educator" for 2002.

The Alliance for Radiologic Excellence will meet in Washington, D.C., on 24 February 2003. The big push again is to work on the Consumer Assurance of Radiologic Excellence (CARE) Act. There are currently 55 congressional cosponsors on H.R. 1011 from the 107th Congress. A new draft is underway for the 108th Congress. For more information, go to ASRT's website at www.asrt.org. Please send me any questions or comments you have. The MR section of the CARE Act will follow the guidelines newly established by the JRCERT as well as the SMRT's curriculum guide.

The SMRT is proud to announce that it will continue working in consultation with the Joint Review Committee on Education in Radiologic Technology (JRCERT) for MR Standards for the accreditation of MR Educational Programs. The *Standards for an Accredited Educational Program in Magnetic Resonance* has been adopted by the JRCERT and will become effective 1 January 2003. The SMRT is dedicated to the promotion of education and training in MR. Because of our commitment to

Continued on page 7

excellence in MR education, the SMRT has been and will continue to assist the JRCERT with finding candidates for the MR subcommittee. A mix of MR educators, technologists, and physicists will serve on the MR subcommittee. More information about the new standards for educational programs will be available on the JRCERT website, http://www.jrcert.org throughout the coming year.

Global Development Subcommittee

The Chair of the Global Development Subcommittee of the External Relations Committee is Muriel Cockburn, from Glasgow, Scotland. Muriel has been working hard to build more international relationships with the SMRT. Since the SMRT is an international organization, it is important for the SMRT to reach out to technologists throughout the world. Besides the British Association of MR Radiographers (BAMRR), which the SMRT joined forces with in 2001 to host the 2001 Annual Meeting in Glasgow, and the Australian & New Zealand Local Chapter that blossomed after the Annual Meeting in 1998, more countries are becoming interested in collaborating with the SMRT. Johan Nahuis, an SMRT member and member of the Dutch Society of Radiographers and Radiotechnicians, called the NVRL, is currently working on building cooperative efforts with the SMRT. Muriel is also in contact with representatives from Korea, Ireland, and several Pacific Rim countries. The SMRT looks forward to continuing the challenge of being the best international source for education and professionalism for MR technologists. ●

Thoughts on SMRT Membership

Raymond Cruz, R.T. (R)(MR), 2002- 2003 SMRT Membership Committee Chair

Currently radiology as well as the rest of healthcare, is experiencing a shortage of qualified staff. In the physical sense, there just are not enough bodies to fill the current positions. Contributing to the increasing vacancies at MR sites is the acceptance and use of MR in the healthcare community. In a recent report by IMV Medical Information, June 2002, "MRI is experiencing an annual growth rate of 15%," (see article excerpt at end of this column). Add that 50% of registered technologists will be retiring within ten years, according to ASRT. With these statistics, we would be left with the impression that there is no end to this technologist shortage.

However, a close look at the economy gives us the highest unemployment rate in ten years. "The Labor market hasn't seen the worst of this slowdown" from Richard Brenner, chief US economist at Morgan Stanley. What we have here is a classic *supply and demand* scenario. In a conversation with the director of a regional Radiology school, in all these years, he has never had so many applicants. These applicants, many holding BA's and MA's, have no healthcare background.

The flood of technologists into Radiology will overflow the gunwale of your Diagnostic Imaging Department with some, hopefully and happily, flowing towards MR. What I propose during the coming flood of future technologists is that we as members of SMRT and with pride for the profession make an effort to show these apprentice MR technologists the benefits of SMRT membership.

According to the ARRT website, there are 227,863 registered technologists, of which 12,784 are MR registered. The SMRT has 1,053 current members in the US (4/2002). Our goal should be to at least double the number of SMRT members, in the coming years.

In the relationship of SMRT members and students, there is no data on how many are trained or assisted by members. Yet we are involved, either in training or assisting in some part, in their introduction to MR. For those of us who are, this contact should be our opportunity to impress on these fresh minds the benefits and advantages of SMRT membership.

The main goal of the SMRT is education. SMRT members demonstrate a continuing drive for education and improvement of the profession. Let me point out one of the more remarkable, advantages of membership, the *SMRT Educational Seminars,* home study series.

Continuing education can be very costly. Membership in SMRT can dramatically keep the cost down per CEC (continuing education credit). Compare a seminar that costs $100 for a one-day event. Then add travel expense, and maybe lodging, plus other expenses that normally can be incurred in participating. This can total well above $250 for the usual eight credits. That comes out to $32 a credit. Compare the home study series, one of the membership benefits. As a member of SMRT at $75 per year, you have the opportunity to earn 12 or more credits a year, (plus other benefits). The cost to a member then is approximately $6.50 per credit. All this, plus being able to do this from the comfort of home or some quiet café.

Time is also a big factor in acquiring Continuing Education Credits. Seminars are not always scheduled at one's available time. Here again, a home study course can be done at your convenience. Let me be fair about one factor: you will miss the after-seminar get-together. You could call or e-mail almost any member to ask a question or chat about any subject.

The next MR student that you explain the difference between variable bandwidth and flip angle, mention that they can continue their education through SMRT membership and the home study program. Oh, and give them an application. Pass one on to your fellow technologist who wants to check out your home study.

The following is an excerpt from a June 2002 news release by Mitchell Goldburgh, reprinted with permission from IMV. IMV Medical Information Division, Inc. is a marketing research and consulting firm founded in 1977 specializing in medical and other advanced healthcare technology markets.

IMV Medical Information Division's March 2002 Market Summary Report of 4,401 sites with fixed MRI systems reveals that MRI is experiencing an annual growth rate of 15%, resulting in 18 million procedures in 2001. Examination of the MRI procedure data illustrates emerging application trends for MRI. Vascular MRI procedures are performed in 58% of the MRI sites, growing from 1% of 1994 MRI procedures to 4% of 2001 procedures, totaling 830,000 in 2001. Breast and cardiac procedures, while constituting only 1% of procedures each, are conducted by 23% and 13% of the MRI sites, respectively.

"The clinical performance of the 1.5T and higher field magnets continues to drive MRI purchases. Over 60% of the MRI installed base have 1.5+T magnets, and the reported plans for MRI purchases are consistently for high field systems," reported Mitchell Goldburgh, Vice President and General Manager of IMV. "Patient comfort and access issues made low- and mid-field open field popular in recent years, but shorter bore 1.5T systems for sites that want the advanced clinical capabilities of high field systems appears to be an acceptable solution. In the late 1990s low-field open systems expanded the MRI market, particularly in imaging centers. Going forward nearly half of future purchase intentions are for short bore closed systems, while the rate of acquiring regular closed bore and open systems has declined." ●

Precessing in a Vertical Field

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

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This week I was pulled into a thread on the MRI List Server. It started with someone asking why insurance companies didn't reimburse facilities based on the field strength of their MR system. This seemed, in the opinion of the author, to be fair since low-field system produced lower quality studies. I don't know what happened to me. My grandmother would have said it would be better to keep quiet and have people wonder why you didn't speak rather than speaking and having people wonder why you did. My initial reply was that field strength alone was not a marker of image quality. Other people weighed in and I continued to reply. My grandmother would really be upset with me now. Eventually, I sounded like I was saying that the best technologists and radiologists could make a low-field system sing the "Hallelujah Chorus" and leave a high-field system wondering where to plug in their amp.

I thought I'd use this column to set the record straight. The first thing someone should come to grips with when scanning on a low-field system is that it is just that: a low-field system. I've consulted with some facilities that never seemed to understand this concept.

Basically, it's a low-field system– get over it. I've heard speakers at conferences say that they could do anything on their low-field that can be done on a high-field system. I have often wondered what exactly they were thinking when they arrived at that conclusion. It is interesting that many high-field sites are honest when confronted with a patient who is too large for their system or who is too anxious and not a good candidate for sedation. If the facility does not have a vertical-field system to accommodate the patient, they will refer them to another facility with a vertical field system. On the other hand, low-field vertical-field magnet sites seem to almost never refer a patient to a high-field system when the patient may best be served by being scanned at a higher field.

MR signal-to-noise (SNR) is, among many things, field strength dependent. In fact, it is basically a linear relationship. If you are scanning at 0.2 T, than you have 7.5 times less SNR compared to scanning at 1.5 T. This cannot be compensated for by software or gradient capabilities. Longer scan times are inevitable. Throughput (i.e. "let's book them every 30 to 45 minutes and do the same number and type of series we do on the high-field.") is best planned by taking some advice from Clint Eastwood, who as "Dirty Harry" once said, "A man's got to know his limitations." Quit trying to scan that low-field system like a high-field system.

Now that I've seemed to bash low-field systems, let's look at another myth I've encountered. This myth was addressed by Dr. Kanal over 10 years ago in an article he wrote for *Diagnostic Imaging* to the effect that pretty pictures were not always the most diagnostic. This was in the early days when GRE sequences were the redheaded stepchild of MR. The important focus of an MR study should be to demonstrate the pathology and/or provide the referring physician with information that can be used to help the patient. In my opinion, this means that the final product is not the scanner or the images, but rather the report.

Producing a report that can be used in the treatment of the patient means, again in my opinion, tailoring the study to patient. While I understand the need for certain routine protocols, I don't think "cookie-cutter" protocols are the answer any more than the approach of "lets-scan-every-sequence-and-we-should-see-the-pathology" seems to be. Whether we are scanning the patient at low- or high-field, getting the answer is the final goal and that should be our focus.

Attaining this goal requires a high-quality MR study. What is high-quality? Is it high SNR, good contrast resolution, or very high spatial resolution? Defining good image quality is not as straightforward as it seems. If the pathology can be demonstrated by a fast gradient echo sequence because the patient can't hold still due to pain, what does it matter if the pixel dimensions are greater than 1.0 mm? Let's take it further: what if the pathology can be demonstrated using a 0.2 T system? Does this mean the patient was unjustly served? Absolutely not! If the patient is diagnosed or their treatment is helped by the MR study, what does it matter what field strength was used?

Let's be honest. Most of us adopt the mantra of the field strength and/or vendor of the system on which we currently work. High-field systems tout high quality and high throughput. Is high throughput good if we don't adequately scan the patient? In a recent presentation I asked if one would rather be scanned on a high-field system by an incompetent technologist and have the images read by an inexperienced radiologist or have the study performed on a low-field system by a competent technologist and have the images read by a trained and experienced radiologist. I think the bottom line is that it doesn't matter what field-strength system you use if you use it to the best of your abilities to produce the best study for the patient. We all should strive to get the best out of our systems regardless of field strength.

Oh, one more thing. If you got this newsletter in the mail or accessed it online then you are an SMRT member. Are there other technologists at your site that are not members? If so, quit letting them bum *Signals* and home studies off you! Get them to join so they can enjoy the full benefits of the SMRT. If every member gets someone to join, we can double our membership and increase our influence on the profession. Besides, why should you pay for the newsletter and they get to read it for free? ●

New Signs to Help Control Access to the Magnetic Resonance Environment

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www.MRIsafety.com www.IMRSER.org

To guard against accidents, injuries, or damage to magnetic resonance (MR) systems, the general and immediate areas associated with the scanner (also referred to as the MR environment) must have *supervised* and *controlled* access. Supervised and controlled access involves having MR safety-trained personnel present at all times during the operation of the MR facility to ensure that no unaccompanied or unauthorized individuals are allowed to enter the MR environment. In addition, the MR safety-trained personnel are responsible for performing comprehensive screening of patients and other individuals before allowing them to enter the MR system room. The Institute for Magnetic Resonance Safety, Education, and Research recently developed new screening forms for patients and individuals as well as explicit instructions for conducting screening procedures (www.IMRSER.org).

Additionally, it is necessary to educate everyone who needs to enter the MR environment on a regular or intermittent basis (e.g., custodial workers, transporters, security personnel, firefighters, nurses, anesthesiologists, etc.) regarding the potential hazards related to the powerful magnetic field of the MR system. Unfortunately, even with proper MR safety procedures in place, many individuals and patients have inadvertently "wandered" unattended into the MR environment, and these situations have resulted in disastrous consequences.

As one means of helping to control access to the MR environment, the area must be clearly demarcated and labeled with prominently displayed signs to make all individuals and patients aware of the risks associated with the MR system. The content of these signs is particularly important. However, the information shown on most signs currently in use is out-of-date, erroneous, or not displayed in a prominent enough manner. Therefore, new signs with revised content and new information were designed recently to promote a safe MR environment. This article discusses the current "warning" signs, explains the need and rationale for new signs, presents the content of the new signs, and provides recommendations for the placement of these signs in order to help prevent incidents and accidents in MR facilities.

The Old "Warning" Sign

The sign that is utilized at most MR centers in the United States has information that states the following:

WARNING
STRONG MAGNETIC FIELD
NO PACEMAKERS
NO METALLIC IMPLANTS
NO NEUROSTIMULATION SYSTEMS
NO LOOSE OBJECTS

Obviously, given the present state of knowledge pertaining to MR safety, much of this information is outdated or simply incorrect. In fact, according to the Food and Drug Administration document entitled, *Guidance for the Submission of Premarket Notifications for Magnetic Resonance Diagnostic Devices* (issued November 14, 1998), Attachment B, states: "The controlled access area should be labeled *"Danger – High Magnetic Field"* at all entries." Also, this FDA document indicates: "Operators should be warned by appropriate signs about the presence of magnetic fields and their force and torque on magnetic materials, and that loose ferrous objects should be excluded."

The New "Danger" Sign

Therefore, in consideration of the above, the old "warning" sign was recently revised and updated to include the guidance from the FDA as well as the most current findings for MR safety, especially with regard to implanted objects. For example, because the term "warning" does not convey the importance of a situation that may not only be potentially hazardous, but has been responsible for serious injuries and deaths, the newly revised sign now states (Figure 1A):

DANGER!

Figure 1A. *New sign (enlarged to show detail) designed to help control access to the MR environment. This sign should be placed on the door to the MR system room. A, Top part of sign.*

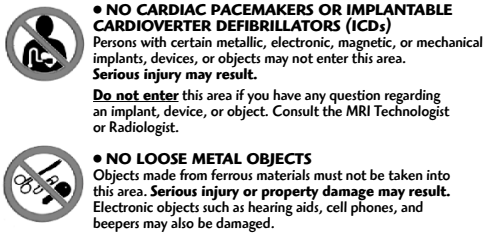

Figure 1B. *Bottom part of the new sign.*

Continued on page 10

Additionally, to inform everyone about the powerful magnetic field associated with the MR system, especially individuals unacquainted with MR technology, the following information is prominently shown on this new sign:

RESTRICTED ACCESS
STRONG MAGNETIC FIELD
THE MAGNET IS ALWAYS ON!

With respect to the information for implants and devices, in addition to cardiac pacemakers, implantable cardioverter defibrillators (or ICDs) are also potentially hazardous for patients and individuals in the MR environment. Therefore, this information is included on the new sign. Also, because recently published reports have indicated that certain neurostimulation systems are safe for patients undergoing MR procedures if highly specific guidelines are followed (Rezai et al. 2002; Finelli, et al. 2002), the statement regarding neurostimulation systems was deleted to avoid undue confusion.

Notably, recent articles in the peer-reviewed literature have reported that many types of metallic implants are *actually safe* for patients undergoing MR procedures. Comprehensive information for over 1,100 implants, devices, and other objects is readily available to all MR healthcare professionals in a recently published textbook (Shellock, 2003) and on-line at www.MRIsafety.com, including information for more than 150 implants and devices tested at 3-Tesla. Accordingly, this information is now clarified on the revised sign. Furthermore, individuals and patients are informed to consult MRI professionals if there are any questions regarding this matter, as follows:

Persons with certain metallic, electronic, magnetic, or mechanically-activated implants, devices, or objects may not enter this area. Serious injury may result.

Do not enter this area if you have any question regarding an implant, device, or object. Consult the MRI Technologist or Radiologist.

Finally, the statement, "NO LOOSE OBJECTS" on the current "warning" sign is rather simplistic and does not address other aspects of concern with respect to bringing potentially problematic items into the MR environment. Accordingly, the new sign states:

Objects made from ferrous materials must not be taken into this area. Serious injury or property damage may result. Electronic objects such as hearing aids, cell phones, and beepers may also be damaged.

Thus, this new sign is more prominent, the term "danger" rather than "warning" is used (which, hopefully, will make individuals and patients readily take notice), and the overall content is more accurate with respect to current MR safety information. A Spanish language version of this sign has also been created.*

Additional New Signs

Two other "danger" signs were created to help control access to the MR environment (Figures 2 and 3). One sign states:

DANGER!
RESTRICTED ACCESS
STRONG MAGNETIC FIELD
This Magnet is Always On!
NO ENTRY BY UNAUTHORIZED OR UNACCOMPANIED INDIVIDUALS AND PATIENTS

The intent of this sign is to prevent the inadvertent entry of individuals and patients into the MR environment.

Interestingly, many individuals fail to realize that the MR system's static magnetic field is always on. In fact, investigations of various accidents that involved relatively large ferromagnetic objects like oxygen cylinders, chairs, IV poles, and wheelchairs revealed that the offending hospital personnel thought that the powerful magnetic field was activated only during the MR procedure. Therefore, a new sign (Figure 3A) was created that indicates:

DANGER!
THIS MAGNET IS ALWAYS ON!

*To obtain the new signs designed to help control access to the MR environment, please visit www.Magmedix.com or contact Frank G. Shellock, Ph.D. at the Institute for Magnetic Resonance Safety, Education, and Research, www.IMRSER.org

Sign Placement

The strategic placement of signs in and around the MR environment is crucial to ensure that all individuals and patients see them before entering this area. In general, the new sign shown in Figure 1 should optimally be

***Figure 2.** New sign designed to help control access to the MR environment. This sign should be placed at the entrances to the MR environment.*

***Figure 3A.** New sign designed to help control access to the MR environment.*

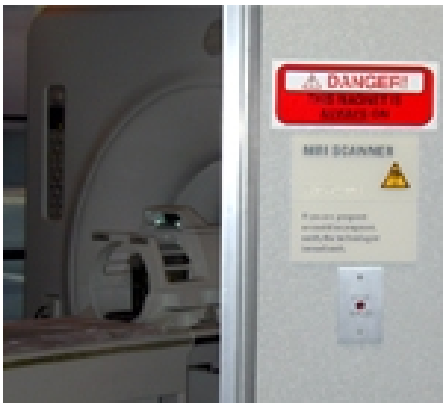

***Figure 3B.** This sign should be placed near the doorframe so that it can be viewed by individuals and patients, especially if the door to the MR system room is open.*

Continued on page 11

placed on the door or entrance to the MR system. The sign in Figure 2 should be placed on doors that serve as exterior entrances to the MR environment. The sign that states: DANGER! THIS MAGNET IS ALWAYS ON! should be placed near the doorframe so that it can be viewed by individuals and patients, especially if the door to the MR system room is open (Figure 3B). ●

References

1. Finelli DA, Rezai AR, Ruggieri P, Tkach J, Nyenhuis J, Hridlicka G, Sharan A, Gonzalez-Martinez J, Stypulkowski PH, Shellock FG. MR-related heating of deep brain stimulation electrodes: an in vitro study of clinical imaging sequences. *American Journal of Neuroradiology* 2002;23:1795-1802.
2. Rezai AR, Finelli D, Nyenhuis JA, Hrdlick G, Tkach J, Ruggieri P, Stypulkowski PH, Sharan A, Shellock FG. Neurostimulator for deep brain stimulation: *Ex vivo* evaluation of MRI-related heating at 1.5-Tesla. *Journal of Magnetic Resonance Imaging* 2002;15:241-250.
3. Shellock FG. MR safety update 2002: Implants and devices. *Journal of Magnetic Resonance Imaging* 2002;16:485-496.
4. Shellock FG. Biomedical implants and devices: assessment of magnetic field interactions with a 3.0-Tesla MR system. *Journal of Magnetic Resonance Imaging* 2002;16:721-732.
5. Shellock FG, Tkach JA, Ruggieri P, Masaryk T, Rasmussen P. Aneurysm clips: evaluation of magnetic field interactions using "long-bore" and "short-bore" 3.0-Tesla MR systems. *American Journal of Neuroradiology* (in press).
6. Shellock FG, Tkach JA, Ruggieri PM, Masaryk TJ. Cardiac pacemakers, ICDs, and loop recorder: Evaluation of translational attraction using conventional ("long-bore") and "short-bore" 1.5- and 3.0-Tesla MR systems. *Journal of Cardiovascular Magnetic Resonance* (in press)
7. Shellock FG. Reference Manual For Magnetic Resonance Safety: 2003 Edition, Amirsys, Inc., Salt Lake City, UT (www.Amirsys.com and www.Elsevier.com).
8. U. S. Department Of Health and Human Services, Center for Devices and Radiological Health Food and Drug Administration, the document entitled, Guidance for the, Submission of Premarket Notifications for Magnetic Resonance Diagnostic Devices, Issued November 14, 1998.

For more information on safety related issues, please visit:

MRIsafety.com

This website was created and is maintained by Frank G. Shellock, Ph.D.

IMRSER
Institute for Magnetic Resonance Safety, Education, and Research

Magnetic Resonance Imaging of Nuclei other than Hydrogen

Denise Davis, B.S., R.T. (R)(MR)

Recent statistics indicate 18 million MRI procedures were performed at 4,401 sites in 2001.[1] This is an incredible number considering it was just twenty-nine years ago the first Fourier encoded MR image was produced. There is no denying that magnetic resonance is a powerful tool. Exquisite contrast resolution over radiographic imaging and its ability to characterize soft tissue in both normal and diseased states are what sets this modality apart from other imaging techniques. So is it possible to capitalize on these advantages and image nuclei other than hydrogen? The short answer is YES!

The ability to produce magnetic resonance images from hydrogen as well as other nuclei is dependent on several factors:

1. Natural Abundance – how prevalent is the isotope in nature.
2. Sensitivity – how strong is each one.
3. Concentration of nuclear spins – how many of each nuclei are available in the sample.

Of course the nucleus that is best suited for MR imaging is the proton, the positively charged hydrogen nucleus, due to its large tissue concentration and sensitivity. For example, the body of a 120-pound human female contains about 5,448 grams of hydrogen as opposed to 76 grams of sodium,[2] another nucleus of interest for magnetic resonance imaging. The list of nuclei that fit the above criteria is short, but some success has been achieved with the availability of higher magnetic field strengths and specialized hardware and software.

The ability to obtain data as a complement of hydrogen imaging may provide new knowledge to aid in the early diagnosis and treatment of many diseases. For example, stroke is considered the third largest cause of mortality and a notable source of disability in the United States. Several trials have shown that administration of thrombolytic agents within three hours of the onset of an acute ischemic stroke can reverse neurological deficits.[3] Hydrogen MR imaging aids in the location and type of stroke. Newer techniques, like diffusion and perfusion hydrogen imaging, aid in the detection of acute stroke. However, they cannot identify whether the ischemic areas contain viable tissue. Research studies have shown that sodium magnetic resonance imaging CAN assess tissue viability based on tissue sodium concentration measurements.[4] The remainder of this article will discuss why it may be beneficial to collect image data from other nuclei as a complement to routine hydrogen imaging.

Phosphorus Imaging

Phosphorus is an element that humans need for growth. It aids in the maintenance and repair of all body tissues and can be found in the bones, the brain and the nerves. As shown in Table 1, its high abundance and sensitivity for MR detection suggests that phosphorus may be suitable for

Continued on page 12 ➠

Table 1. MR characteristics of various nuclei.

Nucleus	Spin Quantum Number[2]	Resonant frequency at 1.5 Tesla	Natural Isotopic Abundance[5]	Relative Sensitivity
^{1}H (Hydrogen)	1/2	63.864 MHz/T	99.985%	1
^{13}C (Carbon)	1/2	16.058 MHz/T	1.108	0.016
^{19}F (Fluorine)	1/2	60.083 MHz/T	100	0.834
^{23}Na (Sodium)	3/2	16.893 MHz/T	100	0.093
^{31}P (Phosphorus)	1/2	25.854 MHz/T	100	0.066

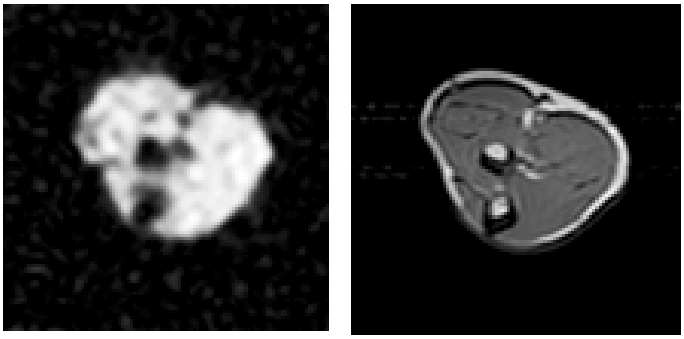

Figure 1 A/B. *Axial phosphorus image of the forearm of a normal subject and a high-resolution hydrogen image in the same slice plane.*

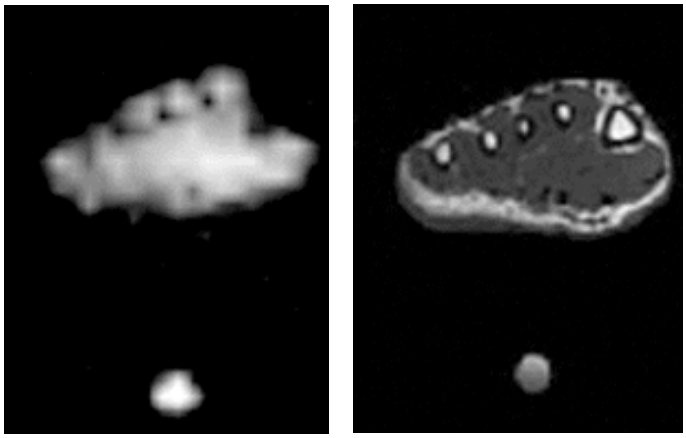

Figure 1 C/D. *Left: Axial phosphorus image of the foot of a normal subject. Right: A high-resolution hydrogen image in the same slice plane.*

Both sets of images were acquired on the Beth Israel Deconess Medical Center's 3T MR Scanner. *Images courtesy of Robert Greenman, Ph.D.*

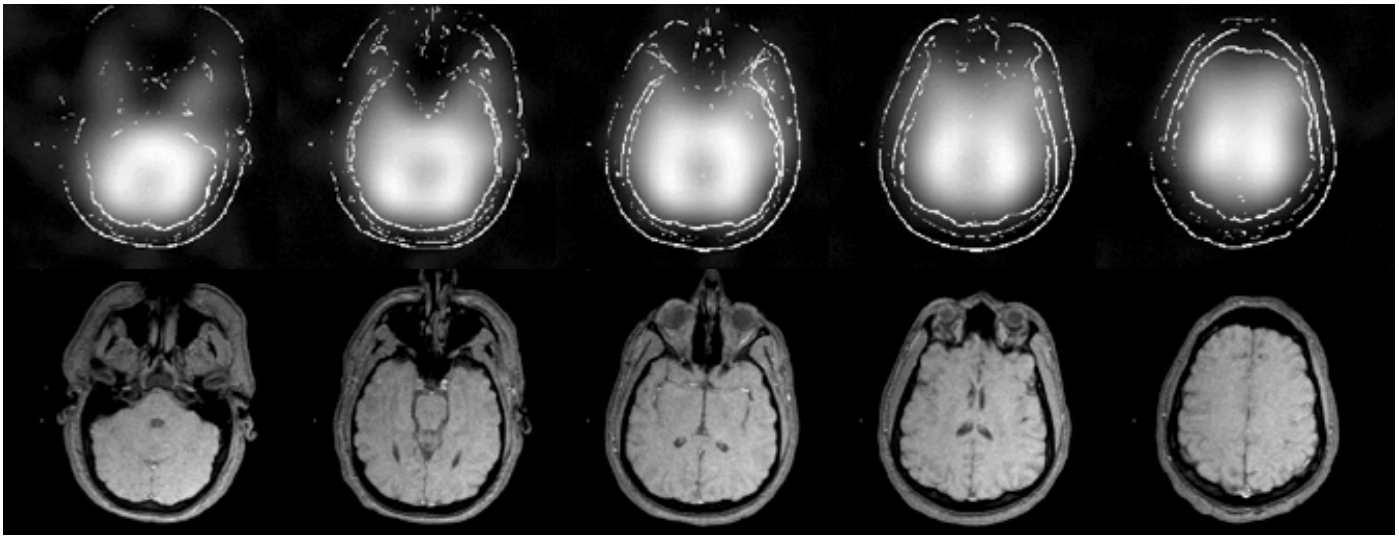

Figure 2. *Top row shows images of total concentration of all detected metabolites at each voxel. Bottom row shows hydrogen images of the same locations.* *Image courtesy of Andrew Maudsley, Ph.D., University of California San Francisco and VA Medical Center.*

MR imaging. One application for phosphorus imaging is in assessing musculoskeletal physiology. Adenosine triphosphate (ATP) and phosphocreatine (PCr), along with inorganic phosphate (P_i), are the main phosphorus containing metabolites involved in energy transfer throughout the body. When we exercise our muscles, the normally large concentrations of ATP and PCr decrease. Once exercise is stopped, recovery occurs within minutes and concentrations return to the levels required to maintain cellular function. For a fixed amount of cellular work, healthy muscle exhibits a smaller increase in the PI/PCr ratio than diseased muscle. When aerobic metabolism becomes impaired as a result of pathology, anaerobic metabolism becomes the primary source of ATP leading to a concomitant increase in lactic acid and a decrease in ph. This decrease in ph is readily measurable using ^{31}P spectroscopy and could be used to monitor changes in metabolic activity well before anatomical abnormalities can be detected using routine hydrogen MRI.

Phosphorus imaging is a challenge because, despite the fact that it has a large natural abundance, its sensitivity and tissue concentration are low compared to those of water protons. Techniques for increasing the MR signal intensity include specialized hardware such as phased array coils and custom pulse sequences. However, the biggest advantage will come with the FDA approved very high field systems (3.0 Tesla) available in the clinical market today. One application for this imaging could be to identify viable versus non-viable tissue in diabetic neuropathy. The foot images in Figure 1 are examples of the quality of phosphorus imaging you can acquire with these very high field systems. The ability to correlate the metabolic state of the muscle in the vicinity of a wound with the likelihood that the wound will heal could be a powerful diagnostic complement to high-resolution hydrogen imaging. Another application is in neuroimaging where ^{31}P spectroscopic imaging has been found to be of great aid for the early diagnosis of schizophrenia and other mood disorders. Figures 2 and 3 show brain phosphorus images of total

Continued on page 13

concentration for all detected metabolites. Corresponding hydrogen images are shown in Figure 2. These examples illustrate how phosphorus and hydrogen MRI can be combined to provide important quantitative information about healthy and diseased tissue form and function.

Sodium Imaging

Another nucleus of interest for MR imaging is sodium. Sodium is an essential element to human health. Our cells are bathed in serum (salt water) that is high in sodium and low in potassium. This salt water passes through each cell via the sodium potassium pump, which removes intracellular sodium and replaces it with potassium using ATP as its energy source. This movement of sodium from one side of a cell to the other drives the absorption of water. Cell damage occurs when cells cannot maintain high enough levels of potassium to refuse sodium. Disease processes such as stroke or tumor can damage the integrity of this pump and impact the viability of the cell. Sodium MR imaging can be used to provide quantitative measurements for many clinical applications. Figures 4 and 5 are examples of complementary sodium images for a brain tumor. Research studies have shown that tumor sodium concentration increases with the tumor's proliferation activity.[6] This information can be used to tailor a patient's therapy and to gauge its response. Another application for sodium quantification is in cardiac imaging (Figure 6), where the potential to differentiate viable versus ischemic myocardium can be performed non-invasively.

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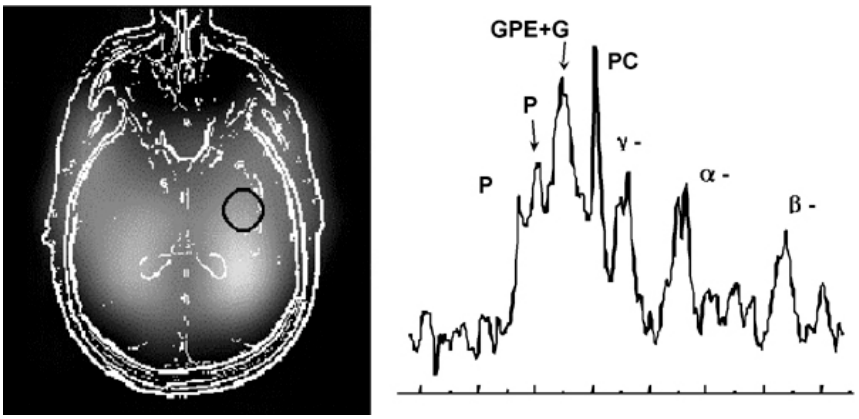

Figure 3. *Phosphorus Image acquired at 1.5 Tesla with spectra from ROI 3D MRSI, 12x12x12 phase encodings, effective volume/voxel of 26cc, Spin Echo, TE=3.2 ms.*
Image courtesy of Andrew Maudsley, Ph.D., University of California San Francisco and VA Medical Center.

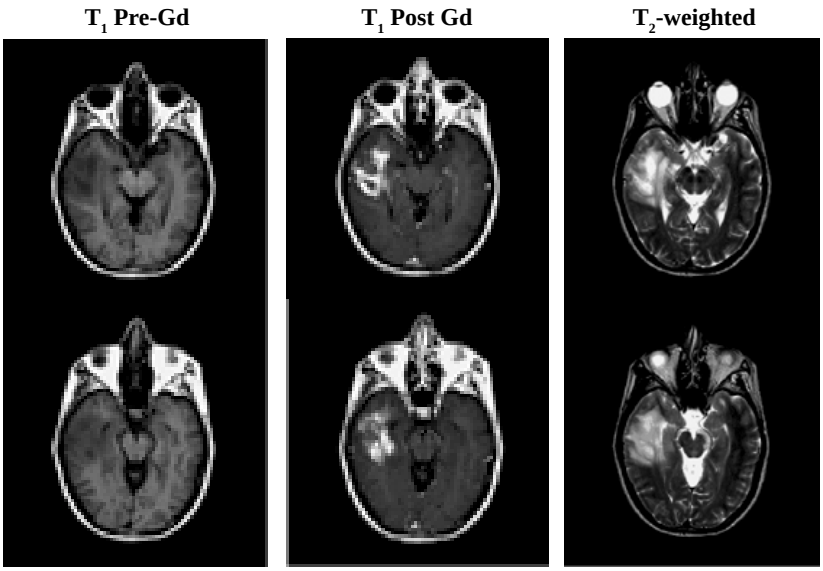

Figure 4. *Hydrogen MR Imaging of a Brain Tumor done on a 3 Tesla Magnet.*
Images were acquired on the University of Pittsburgh, MR Research Center 3 Tesla Magnet.
Image courtesy of Fernando Boada, Ph.D.

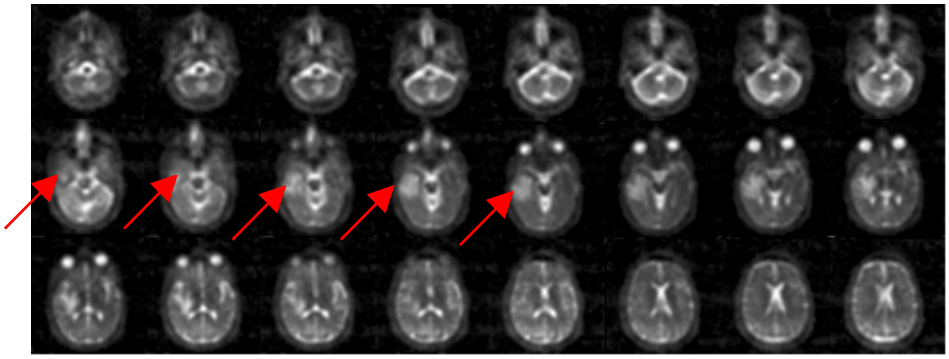

Figure 5. *TQ Sodium MR Imaging of a Brain Tumor done on a 3 Tesla Magnet TR=100ms, TE=0.4ms, Voxel size=0.06cc, DAT=9 minutes.*
Images were acquired on the University of Pittsburgh, MR Research Center 3 Tesla Magnet.
Image courtesy of Fernando Boada, Ph.D.

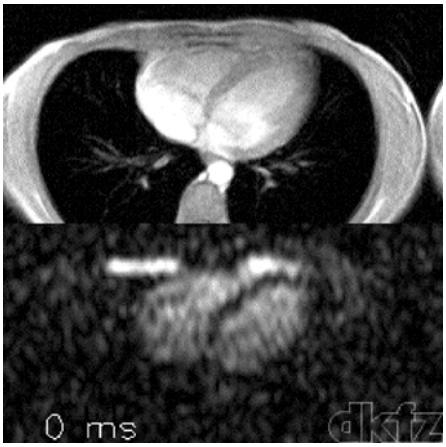

Figure 6. *Hydrogen image of the heart of a healthy volunteer on top. Bottom is a sodium image.*
Image courtesy of Renate Jerecic, DKFZ Imaging Group, Heidelberg, Germany.

2002 3rd Place Proffered Paper–
Clinical Poster Presentation

Contrast-Enhanced 3D MRA Screening of Non-Peripheral Arterial Vasculature in 30 Minutes

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Purpose

3D CE MRA has been shown to provide excellent depiction of cardiovascular anatomy.[1] Total body vascular imaging requires in-plane fast 3D gradient echo pulse sequences, numerous phased array receiver channels and fast array processors for data calculation and processing.[1-4] Combined with these recent hardware and software developments, a non-arterial invasive technique with multiple intravenous administrations of a paramagnetic contrast agent is required.[1] Due to lower risk factors associated with the CE MRA method, MRI is becoming an ideal imaging modality for angiographic assessment.[1-2] Whole body MR arteriography often requires longer ET and high volumes of contrast administration for complete vascular capture. The purpose of this study was to evaluate a method for screening the entire non-peripheral arterial anatomy in less than thirty minutes total ET using CE MRA techniques.

Method

Informed consent was obtained from eight healthy adult subjects. Imaging was performed on a Siemens 1.5 Tesla MR system (40mT/m amplitude, 200mT/m/msec slew rate) with an interactive phased array (IPA) coil system head, spine, body and body extender segments utilized. An 18G catheter was placed in the right antecubital vein and attached to an automated power injector (MED RAD). The data was collected using the following 3D Flash breath-hold sequence parameters: stage 1) sub-second coronal and sagittal planes, TR / TE = 1.8/0.6 msec, flip angle = 18°, matrix = 172 x 256 mm, slab thick. = 114 mm, eff. slice thick. = 19 mm, 6 partitions, dynamic phases = 18, partial k-space, BW = 1300 Hz/pixel; 100%FOV = 350 mm, total TA = 24 sec, see Figures 1 & 2; stage 2) high resolution coronal plane, TR / TE = 1.9/1.0 msec, flip angle = 20°, matrix = 307 x 512 mm, slab thick. = 75 mm, eff. slice thick. = .85 mm, 88 partitions, partial k-space, BW = 610 Hz/pixel; 62%FOV = 300 mm, total TA = 19 sec, see Figure 3; stage 3) four second coronal plane, TR / TE = 1.8/0.6 msec, flip angle = 17°, matrix = 192 x 256 mm, slab thick. = 120 mm, eff. slice thick. = 3 mm, 40 partitions, dynamic phases = 6, partial k-space, BW = 1200 Hz/pixel; 87%FOV = 380 mm, total TA = 26 sec, see Figure 4. A dose of 6cc gadolinium (GD) at a rate of 6cc/sec followed by a 15cc normal saline (NS) flush at a rate of 5cc/sec was administered in stage 1 simultaneously with start of multi-phase acquisition using total of 6 IPA elements to include pulmonary and aortic arteries; dynamic data was used to determine timing for 2nd and 3rd stages. A dose of 18 cc GD at a rate of 2cc/sec followed by a 15cc NS flush at a rate of 2cc/sec was administered in stage 2 using appropriate corresponding arrival time after pre-contrast data set and prior to start of post contrast data, using 5 IPA elements to include COW, carotid, vertebral and origin arteries. A dose of 16cc gadolinium GD at a rate of 4cc/sec followed by a 15cc NS flush at a rate of 4cc/sec was administered in stage 3, four seconds after start of multi-phase acquisition using 6 IPA elements to include abdominal arteries through iliacs. All data was calculated and processed using online subtraction (OLS) algorithm for real-time subtraction and maximum intensity projection (MIP) views. Data was evaluated for sufficient signal and visualization of arterial anatomy for screening from COW thru iliac arteries. Times were recorded at start of all subject scanning and recorded at end of last OLS data set and MIP calculation for a total ET.

Results

MIP images were evaluated for sufficient anatomical demonstration and adequate signal intensity for arterial anatomy from COW through iliac arteries. Total constant GD volume required was 40cc. Total ET recorded for all data sets ranged from 26 minutes to 30 minutes for a mean ET = 28 minutes. OLS tool provided real time processing of multiple 3D data sets for a rapid screening assessment of entire non-peripheral arteries. All CE MRA data acquisition, processing, subtraction and MIPs were performed within 30 minutes time.

Discussion

Advanced CE MRA hardware and software techniques provide significant information for anatomical screening and characterization of vasculature. Total body vascular imaging often requires extended ET and larger total contrast volumes. When CE MRA is combined with appropriate timing sequence, dosage and OLS processing, a practical approach for non-peripheral arterial screening within 30 minutes can be obtained. ●

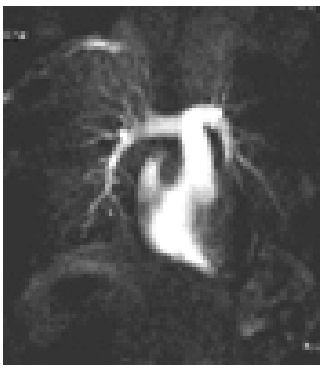


Figure 1. *Stage 1 COR MIP.*

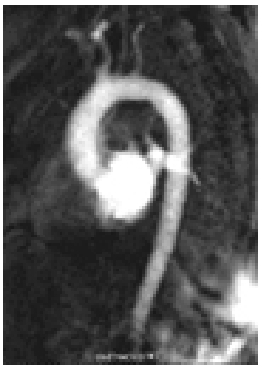


Figure 2. *Stage 1 SAG MIP.*

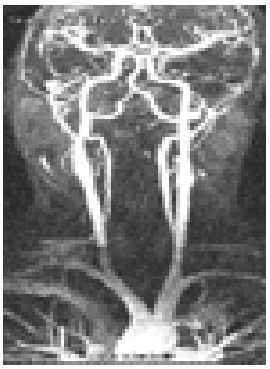


Figure 3. *Stage 2 COR MIP.*

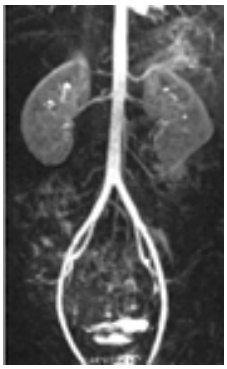


Figure 4. *Stage 3 COR MIP.*

References

1. Ruehm SG. *J Magn Reson Imag.* 2001; 13: 402-411.
2. Goyen M. *J Magn Reson Imag.* 2001; 13: 372-377.
3. Schoenberg SO. *J Radiology.* 1999; 211: 667-679.
4. Wang Y. *Magn Reson Med.* 1996; 36: 551-556.

Other Nuclei

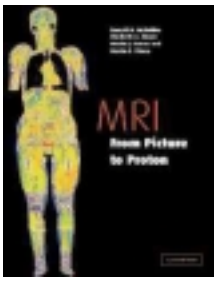
Hydrogen has clearly been the nucleus of choice for magnetic resonance imaging. But as you can see, it is feasible and desirable to complement hydrogen imaging studies with the quantitative information you can get from MR imaging of other nuclei. Researchers are currently looking at carbon and fluorine. Fluorine imaging has been used to study tumor growth and blood flow. Magnetic resonance imaging continues to evolve. Many of the techniques exclusive to the research environment are now achievable on 3 Tesla clinical scanners. What an exciting time to be working in this profession! ●

References

1. IMV Limited, Medical Information Division; www.imvlimited.com
2. Web elements – the Periodic Table on the WWW; www.webelements.com
3. Contemporary Diagnosis and Management of Stroke, J. Weinberger, MD, Handbooks in HealthCare, 1999
4. Comprehensive MR Imaging Protocol for Stroke Management: Tissue Sodium Concentration as a Measure of Tissue Viability in Nonhuman Primate Studies and in Clinical Studies, Thulborn et al, Radiology, Vol. 213, No.1, Pages 156-166, October 1999
5. Clinical MRI, Edelman and Hesselink, 1990
6. Quantitative Tissue Sodium Concentration Mapping of the Growth of Focal Cerebral Tumors With Sodium Magnetic Resonance Imaging, Thulborn et al, Magnetic Resonance in Medicine 41:351-359, 1999
7. Magnetic Resonance Imaging, Physiological and Biological Principles, Bushong s, C. V. Mosby Company, 1998

Book Review

By Muriel Cockburn, SMRT Policy Board Member and Past-President, BAMRR



MRI from Picture to Proton

Written by Donald W. McRobbie, Elizabeth A. Moore, Martin J. Graves and Martin R. Prince

Published by Cambridge University Press www.cambridge.org
ISBN number 0 521 52319 2

I must share this book with all of you. For the people that know me, I love MR, but I have never found the one-stop MR book for me. There is a new book on the block that has just been released. Why did I like it? Well, the title was good, *"MRI from Picture to Proton."* The book has sixteen well laid out chapters with very snappy titles! There is even an appendix on math review (if you feel so inclined!)

The book starts with the history of MR and continues to Part A: The Basic Stuff. Now that is my kind of language, and even better there was not a spinning nucleus in sight (not at this stage). At the end of each chapter there are also good and useful tips for further reading. This book takes you through the MR journey first and then leads into the technical and physics explanation. It is also refreshing that the authors include a small section dedicated to the patient journey before, during, and after the examination.

For new MRI departments, it is always useful to refer to a book for some basic clinical protocols, and these are well written with some very nice diagrams used to illustrate the position of the slices, for example, MRCP and shoulder. Sections such as receive bandwidth and over-sampling, frequency and phase-encoding are well described. If you take time to read and work out the artefact flow chart it is a very useful reference and reminder of the importance of understanding your artefacts!

Part B of the book starts with QA (quality assurance), again a very important topic the significance of which is often overlooked. The section explains why and what we should use QA for. In Chapter 12, "Acronymns Anonymous: A Guide to the Pulse Sequence Jungle," I really liked the explanations and diagrams given for the different types of pulse sequences in conjunction with a detailed guide to the manufacturers' acronyms. This is particularly useful for sites with different makes of scanners. Chapters 15 and 16 take us into spectroscopy and EPI, diffusion and perfusion, and hyperpolarized gas applications. Clear descriptions and superb images illustrate the topics.

The clarity of the text and diagrams and the use of coloured text for emphasis make this book a superb reference manual and practical guide to MRI. The humour in the book is good and the interest and passion of the authors shines through. The section titles make you want to read more. Here's one example: "MRI Liposuction: Removing the Fat Signals." In my opinion this book is a big hit and should be made available in your MRI departments. ●

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ISMRM/SMRT CALENDAR

ISMRM 11th Scientific Meeting & Exhibition

10-16 May 2003

Metro Toronto Convention Centre
Toronto, Ontario, Canada

SMRT 12th Annual Meeting of the Section for Magnetic Resonance Technologists

9-11 May 2003

Metro Toronto Convention Centre
Toronto, Ontario, Canada

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Members, take the opportunity to post information about your workplace. SMRT will provide a link from your site listing to any job opportunities that are listed on the SMRT Website.

The SMRT is now hosting the "MRI Technologist List Server"

The MRI Technologist List was designed primarily for the operators themselves, and topics discussed cover all issues related to MRI scanning. Technologists can discuss day-to-day occurrences on MR issues or ask MR related questions. This network allows technologists throughout the world to be connected, offering advice and experiences in the field of magnetic resonance. Check it out on the SMRT Website: http://www.ismrm.org/smrt/listserv.htm

Local Chapter Update

Bobbie Burrow, R.T. (R)(MR), Local Chapter Committee Chair

Currently the SMRT has eight active local chapters: Atlanta, Georgia, USA, Iowa City, Iowa, USA, Springfield, Illinois, USA, Kansas City, Missouri, USA, Wichita, Kansas, USA, Central Pennsylvania, USA, Rhode Island, USA, and Australia / New Zealand

We have a new chapter located in Charlottesville, Virginia, that had their organizational meeting in January. There is also an interest for a local chapter in Philadelphia, Pennsylvania. Several applications have been sent out to others that are interested in starting a local chapter.

These local chapters continue to provide educational meetings to members and non-members throughout the year. Local chapters are ways to encourage new membership to the SMRT as well as provide quality education to MRI technologists in a specific area.

Anyone interested in starting a local chapter in your area please contact Bobbie Burrow by email: bobbie_burrow@emoryhealthcare.org

Are you a new SMRT member? Did you miss an earlier issue?

All of the previously published ***SMRT Educational Seminars*** home studies are now available for purchase by SMRT Members in good standing for only US$20 per issue. For more SMRT membership information or an order form, please e-mail: **smrt@ismrm.org** or visit the SMRT Website: **http://www.ismrm.org/smrt**

The SMRT gratefully acknowledges

MRI Devices Corporation
Waukesha, Wisconsin, USA

for their generous support of the 2003 *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