Signals

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NEWSLETTER OF THE SECTION FOR MAGNETIC RESONANCE TECHNOLOGISTS

IN THIS ISSUE

SMRT Professionals: Do You Have What It Takes?

Maureen Ainslie, M.S., R.T. (R)(MR), President, SMRT

As an SMRT member since 1991, I have been privileged to attend many SMRT sponsored Regional Seminars and Annual Meetings. I am impressed by the continued expansion of these seminars as they work to meet the educational demands of our profession.

The field of MR imaging continues to mature and procedures are complicated and multidimensional. The additional options and enhanced features have placed the burden of continuing education on the MR technologist. As MR professionals, MR technologists must invest in updating and honing their skills to remain competent and to maintain a market presence. Whether you are employed in a fast paced private facility or a tertiary care setting, there is rarely time available for on-site training or extended applications. How do major medical centers, community hospitals, and for-profit MR centers balance the need for training in the midst of the demands of the workday?

I have observed several solutions that attempt to address this challenge. Many institutions opt to provide weekend or off-hours training for staff. Some MR centers will offer financial stipends or academic enrichment accounts as mechanisms for technologists to obtain support for attendance to MR professional meetings. Another solution has been to create a leadership position within the organization whose sole responsibility is the training and development of MR staff.

Several for-profit facilities and institutions have hosted SMRT sponsored regional seminars to provide expanded educational opportunities for their staff and local technologists in their area. These seminars are typically one day and are often held on site of the hosting institution. The local regional chair receives a year's free membership to the SMRT and substantial support from the SMRT Regionals Committee Chair and the Berkeley, California, USA, SMRT office staff. The SMRT will provide a speaker from the SMRT Policy Board who will assist with the activities on the day of the seminar. The program is accredited through the ASRT for ARRT Category A Continuing Education Units (CEU). This is submitted by the SMRT staff in the Berkeley office. These seminars chaired by a local technologist from the sponsoring institution have succeeded in:

- Providing your technologists with the opportunity to earn low cost CEU's.
- Providing an opportunity to design a program that focuses on the needs of local technologists.
- Expanding your staff's awareness of emerging technologies.
- Highlighting your site to local MR professionals as a center committed to Continuing Education.

In order to "have what it takes" to continue to grow and flourish in your chosen profession, consider hosting an SMRT Regional in your area. The rewards are tangible and the payback is significant. ●

Editor's Letter

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

Greetings.

In this issue of *Signals* we bring you news of SMRT activities from near and far. President **Maureen Ainslie** provokes thought with her question about professionalism and how the SMRT is a factor for those of us in the MR field. **Anne Sawyer-Glover** begins her duties as editor of the home study series and shares information about the accompanying offering. **Greg Brown**, Publications Committee Chair, explains how to gain early access to journals. **Julia Lowe**, Education Committee Chair, enthusiastically announces the results of this year's abstract submissions. **Jim Stuppino**, Program Committee Chair, invites you to the rapidly approaching 13th Annual SMRT Meeting. The program is listed for your review along with the paper by **Eric L. Douglas** which received the President's Award as the best overall submission.

The outcomes of recent elections are detailed by **John Koveleski**, Nominations and Awards Committee Chair. **Maureen Hood**, External Liaison, discusses the important topic of Radiology Physician Assistants and how this may affect you and your workplace. Regional Educational Seminars are becoming more frequent as evidenced by the reports in this issue. Be sure to check out reports from **Maureen Ainslie** who hosted her President's Seminar at the Duke University Campus and from **Vera Miller** and **Karen Rich** who hosted the Northeast Seminar in Boston. Future Regional Educational Seminars are scheduled at Bethlehem, Pennsylvania with **Linda Barnis, Megan Mullen,** and **Mark Perna** hosting and at the University of Ottawa with **Rick Heroux** and **Eric Murray** providing the leadership. Watch for the next issue of *Signals* for a report from Cleveland, Ohio from **Julia Lowe, John Dillinger,** and **Virginia Reilly.**

The winners of the MRI Devices Corporation case study contest are listed, anyone you know? Former SMRT Policy Board member **Michael Kean** introduces a new column in this issue discussing the concerns with Pediatric MRI. We appreciate contributions from our regular columnists **Bill Faulkner** and **Frank Shellock** who offer their columns on Low- and Mid-Field scanning and MR Safety, respectively. And as always check the calendars and announcements for upcoming events and activities pertaining to you! ●

Update on *SMRT Educational Seminars*

Anne Marie Sawyer-Glover, B.S., R.T.(R)(MR), Editor, *SMRT Educational Seminars*

We are especially fortunate to be sharing with you a most comprehensive review of *"The Role of Neuroimaging in the Diagnosis of Alzheimer's Disease"* in this quarterly issue of our home study program. Dr. Jeffrey R. Petrella and his co-authors, Drs. Coleman and Doraiswamy from Duke University Medical Center, present a detailed report in "Neuroimaging and Early Diagnosis of Alzheimer's Disease: A Look to the Future." As the diagnosis and clinical treatment of this disease has challenged clinicians and researchers for decades, this all-inclusive article provides information beginning with the significant aspects of pathology and etiology through state-of-the-art imaging techniques in CT, MR, PET, and SPECT.

The SMRT home study program was implemented in 1998 as a way to provide SMRT members with quality educational MR material that provides credits necessary to maintain your registry and/or certification. In addition, these quarterly issues provide on-going education in a field that continues to grow and develop rapidly with regard to software and hardware, imaging techniques, clinical applications, and the on-going need for safety training. The current issue is the twenty-third SMRT home study. Accreditation for all issues is maintained annually by the SMRT. New members can obtain back issues from the SMRT office for twenty dollars each.

Kelly Baron, who has served as editor for the last six years, has succeeded enormously in providing not only the best in peer-reviewed articles but has also organized several issues written by the authors specifically for the SMRT members. Authors have included radiologists and clinicians (M.D.), researchers and scientists (Ph.D.), and technologists. A wide variety of home study topics have been presented including: basic physics, imaging sequences and artifacts, imaging at fields less than 1.0T, cardiac and breast imaging, body and brain imaging, MR angiography, musculoskeletal imaging, MR safety, and some of the more advanced techniques that are quickly becoming routine at many MR facilities: functional MRI, spectroscopy, and interventional procedures. Many, many thanks to Kelly and all of the people who have volunteered their time to review articles, write articles, write questions and answers, review questions and answers, and get these invaluable issues out to you, the members of the SMRT. ●

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

Easy, Early Access to ISMRM Journals

Greg Brown, R.T., SMRT Publications Committee Chair

As members of the SMRT we can subscribe to the two journals associated with our parent organization the ISMRM.

While not for every MRI technologist, the *Journal of Magnetic Resonance Imaging (JMRI)* and *Magnetic Resonance in Medicine (MRM),* published by John Wiley & Sons, are highly regarded journals that present current perspectives and significant research in our field.

About 17% of our SMRT members currently subscribe to *JMRI* with a few subscribing to *MRM* alone, or both. Your journal subscription obviously includes the printed copy sent to your address, but you may not be aware that it also includes electronic access and a CD containing the previous year's journal issues.

If you already subscribe to these journals, enhance the value of your subscription with earlier access and the flexibility of the electronic journals. If you don't subscribe to *JMRI* or *MRM,* visit www.interscience.wiley.com and request a sample copy, to see what you are missing and help decide if this optional benefit of SMRT membership suits your educational needs. ●

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Special Bonus Offer–

A CD-ROM corresponding to your journal subscription will be sent to you free-of-charge as a value-added bonus for being a member of SMRT and choosing an optional subscription. The CD-ROM features:

- An archive of journal content from the previous calendar year.
- Navigation to content on the disk provided in HTML format to recreate a familiar Web-based interface.
- Tables of Contents and full articles from the journal presented electronically exactly as they appear in print.
- A direct link to *Wiley InterScience* registration page for SMRT member subscribers for quick and easy access to the journal's full-text electronic edition, featuring full-text content for all issues since January 1999.

Education Committee Update

Julia Lowe, B.S., R.T. (R)(MR), 2004 Education Committee Chair

The Education Committee is excited to report that once again a variety of high quality papers have been submitted for consideration at the SMRT 13th Annual Meeting in Kyoto. When preparing their work for presentation, the authors decide if the work is to be considered for an oral presentation or a poster presentation. The author also indicates if the work is being done in a clinical setting or a research site. Abstracts tendered are blinded as to author and institution by the SMRT office in Berkeley and then sent to a committee of reviewers for judging and scoring. To preserve resources, the reviewers received copies of the abstracts electronically and submitted their scores electronically, this year. If a member of the committee has an abstract submission, an alternate judge is used for those papers. This year the volunteer review committee members are: Karen Bove Bettis, Greg Brown, Bobbie Burrow, Muriel Cockburn, Cindy Hipps, John Koveleski, Scott Kurdilla, Candi Kaut Roth, and Adam Stevens. Alternate judges are Julia Lowe and Julie Strandt-Peay.

A standardized scale and set criteria are used by the reviewers when judging the abstracts. Each member of the review committee sends their scores to the SMRT office where the scores are combined and the final tally is made. Those papers with the highest scores are chosen for oral presentations within the didactic portion of the program. Posters are scored preliminarily prior to the Annual Meeting with the final judging occurring on site. This allows the appearance of the poster to be considered along with the content. Those with high scores are selected for discussion during the Friday evening Poster Reception. The paper with highest overall score receives the President's Award. The oral and poster presentations are awarded in Clinical Focus and Research Focus with first place, second place, and third place awards. The awards are presented during the Business Meeting on Saturday.

This year abstracts came from many countries throughout the world, demonstrating the truly international flavor of the SMRT. Following is the specific number of abstracts from each country: Australia 2, Belgium 1, Canada 8, China 1, Denmark 5, Germany 3, Korea 4, Netherlands 2, Poland 2, Singapore 2, Sweden 2, Taiwan 1, UK 2, USA 17. Of the 52 abstracts received from these 14 countries, 18 authors preferred an Oral presentation and 34 preferred Posters. Twenty authors indicated their work had a Research Focus and 32 authors stated their work had a Clinical Focus.

Thank you to everyone who took the time and exerted the effort to participate in this important part of the Annual Meeting by sharing your work and thank you to the Education Committee and Abstract Review Committee members for your contribution. ●

Update on the SMRT 13th Annual Meeting

James Stuppino, B.S., R.T. (R)(MR), 2004 Program Committee Chair

It's not too late to make your plans and join us for the Thirteenth Annual Meeting of the Section for Magnetic Resonance Technologists (SMRT) in the wonderful city of Kyoto, Japan, at the Kyoto International Conference Hall, on 14, 15, and 16 May 2004. The meeting will be held in conjunction with the Twelfth Scientific Meeting and Exhibition of the International Society for Magnetic Resonance in Medicine (ISMRM).

Kyoto is located in the Kansai region of Japan and is the seventh largest city with a population of approximately 1.4 million people. Travelers to Kyoto can easily spend a week visiting the city's historical attractions, such as the Kyoto Imperial Palace, Kinkakuji (Golden Pavilion), and Sanjusangendo.

Kyoto is known throughout the world for its stunning beauty. Tourists are drawn year round by the majestic palaces, statues, and villas, as well as by the carefully tended gardens. Each spring dozens of varieties of cherry trees bloom in Kyoto and visitors are treated to time-honored Hanami (blossom viewing) parties. Visitors have two options for travel into Kyoto. Osaka's Kansai International Airport is the closest airport to Kyoto. Kyoto is approximately 70-minutes travel from Kansai's international Airport. The second option would be to fly into Tokyo and take the bullet train which is approximately a 3-hour trip.

The Kyoto program will be designed to fulfill the needs and aspirations of MR technologists/radiographers in both a research and clinical setting. The goal of the SMRT is to provide quality educational opportunities for MR technologists/radiographers and to establish and maintain a high level of professionalism in the field. The meeting will commence with a poster exhibit, poster presentations, and walking tour reception at 18.30 hours on Friday evening, 14 May 2004. This will be a great way to learn about new and innovative clinical and research studies that are being performed by our colleagues world-wide. It also provides a great opportunity to interact with the poster authors and to meet and share ideas with fellow technologists/radiographers from around the world.

An important aspect of the meeting remains the submission of abstracts for oral and poster presentations by technologists/radiographers. Proffered papers submitted by your peers will be interlaced throughout the sessions. These papers and posters have been one of the highlights of the past SMRT meetings and we look forward to this provocative segment of the program. On Saturday, during the Business Meeting, awards will be presented to the authors of the most outstanding papers and posters submitted in both the clinical and research arenas.

Many of this year's topics for the invited speakers were chosen based on comment and feedback received from attendees of previous annual meetings. Some of the topics being presented at this SMRT meeting include: Virtual Colonoscopy, Breast Imaging, Diffusion-Tensor MR Tractography, Ischemic Heart Disease Imaging, MR Spectroscopy, Functional Assessment of the Joints using Cinematic MRI, and other advanced MR topics. One of the popular as well as practical aspects of previous SMRT meetings is the MRI Safety Forum, moderated and chaired by Frank G. Shellock, PhD. Dr. Shellock has graciously offered to moderate and present new material again this year.

As Chair of the 2004 Program Committee it is my pleasure to invite you to attend this meeting and join the SMRT in bringing to technologists/radiographers an exciting quality educational weekend in the wonderful city of Kyoto, Japan.

SMRT 13th Annual Meeting Program *"Rising to Excellence"*

FRIDAY, 14 May 2004

18.30 **Poster Exhibit, Poster Presentations, and Poster Walking Tour Reception**

19.00 "Susceptibility Weighted Imaging (SWI)"
Zahid Latif, R.T., (R)(MR)(CT)

19.10 "Navigator Triggered 3-D Turbo Spin-Echo for MRCP: Comparison with Single Shot Techniques"
Charles Fasanati, R.T. (R)(MR)

19.20 "Use of Gadolinium MR Venography to Evaluate Central Venous Stenosis and Occlusion in Patients on Hemodialysis"
Christopher Au, R.T.

19.30 Break

19.45 "Protocols and Work-flow in Whole-Body MRI Screening"
Ya-Wen Shen, R.T.

19.55 "A New Look into Kicking a Football– An Investigation of Muscle Activity Using MRI"
Kara Baczkowski, R.T.

20.05 Adjournment

SATURDAY, 15 May 2004

07.45 Welcome and Announcements

08.00 **MR Colonography and Virtual Colonoscopy**
Silke Bosk, R.T.

08.55 **3T Imaging**
David Stanley, B.S., R.T. (R)(MR)

09.50 Break

10.00 **Proffered Papers**

1st Place Award– Research Focus
Caron Murray, R.T., A.C.R., (R)(MR)
"Projection Reconstruction and Time Resolved Imaging of Contrast Kinetics in Breast MRI"

2nd Place Award– Research Focus
Caron Murray, R.T., A.C.R., (R)(MR)
"Use of Guidance Software During MR Breast Interventional Procedures"

1st Place Award– Clinical Focus
Mercedes Pereyra, R.T.
"Comparison Between Single Breath-Hold Volumetric Delayed Enhancement Imaging of the Left Ventricle and Navigator Guided Free Breathing 3D DE Imaging"

3rd Place Award– Clinical Focus
Sandra Massing, R.T.
"Assessment of Myocardial Viability using Contrast Enhanced MRI-Comparison of Gd-DTPA and GD-Bopta"

11.00 Awards Luncheon & SMRT Business Meeting

13.15 **MRI for the Management of Haemochromatosis**
Gregory Brown, R.T.

14.10 **State of the Art in Breast Imaging**
Anne Sawyer-Glover, B.S., R.T. (R)(MR)

15.05 Break

15.20 **Male Pelvis**
E. Scott Pretorius, M.D.

16.15 **Proffered Papers**

President's Award
Eric Douglas, R.T., (MR)
"Direct Comparison of Sensitivity Encoding (SENSE) Accelerated and Conventional 3D Contrast Enhanced MR Angiography (CE-MRA) of Renal Arteries: Effect of Increased Spatial Resolution"

2nd Place Award– Clinical Focus
Sandra Massing, R.T.
"Optimization of Contrast-Enhanced Peripheral MR Angiography with Mid-Femoral Venous Compression (VENCO)"

Proffered Paper
David Stanley, B.S., R.T. (R)(MR)
"MR Assessment of Laparoscopic Nissen Fundoplication"

17.00 Adjournment

SUNDAY, 16 May 2004

07.45 Welcome and Announcements

08.00 **Diffusion Tensor MR Tractography**
Roland Bammer, Ph.D.

08.55 **Advances in Abdominal Imaging**
Carolyn K. Roth, R.T. (R)(MR)(CT)(M)(CV)

09.50 Break

10.05 **One Stop Shopping: The 30-Minute Ischemic Heart Disease Exam**
Michaela Schmidt, R.T.

11.00 **Functional Assessment of the Joints using Kinematic MRI**
Frank G. Shellock, Ph.D.

11.55 **Contrast MRA and New Blood Pool Agents**
Martin A. Prince, M.D., Ph.D.

12.50 Lunch

13.30 **Clinical and Research Spectroscopy**
H. Cecil Charles, Ph.D.

14.25 Break

14.45 **Proffered Papers**

3rd Place Award– Research Focus
Helle Juhl Simonsen, (MRT)
"Pathogenesis of Corticospinal Tract Degeneration in ALS Patients by Diffusion Tensor Imaging"

Proffered Papers
Anne Dorte Blankholm, R.T. (MR), Pg.D.
"3D FIESTA (TRUE FISP) Compared to 3D IR-SPGR (Inversion Prepared Spoiled Grass) at C2 Level in the Assessment of Multiple Sclerosis"

Anna Kirilova, R.T., (R)(MR) (MRT)
"Evaluation of PROstate Spectroscopy Examination (PROSE) Sequence in the Treatment and Follow-Up of Patients Pre- and Post- Brachytherapy"

15.30 **MR Safety Forum**
Frank Shellock, Ph.D., Chair and Moderator
Michael Kean, R.T., Alayar Kangarly, Ph.D., Gregory A. Sorenson, M.D., James Stuppino, B.S., R.T. (R)(MR)

17.30 Adjournment

SMRT and ISMRM Joint Presentation:
Managing MR Artifacts and Pitfalls

Kim Butts, Ph.D. and John Christopher, B.A., R.T., Organizers

Monday, 17 May, 13.30 - 15.30

Overview:

This course will describe the physical bases for artifacts in MR imaging. Building upon this information, it will describe how artifacts serve as pitfalls for clinical interpretation of MR images.

Program:

13.30 **MRI Artifacts: A Technical Perspective**
Gregory C. Brown, R.T.

13.55 **The Physics of Cardiac and Blood Flow Artifacts**
David N. Firmin, Ph.D.

14.20 **Neuro and Vascular Pitfalls**
William G. Bradley, Jr., M.D., Ph.D.

14.45 **Body and Cardiac Pitfalls**
Katsuyoshi Ito, M.D.

15.10 **Discussion**

15.30 Adjournment

2004 President's Award–

Direct Comparison of Sensitivity Encoding (SENSE) Accelerated and Conventional 3D Contrast-Enhanced MR Angiography (CE-MRA) of Renal Arteries: Effect of Increased Spatial Resolution

E.L. Douglas, R.T. (MR),[1] B. Lambert, R.N.,[1] M. Pereyra, R.T.,[1] Vei Vei Lee, M.S.,[2] R. Muthupillai, Ph.D.,[1,3,4] S.D. Flamm[1,4]
[1]Department of Diagnostic Radiology, St. Luke's Episcopal Hospital, Houston, Texas, USA; [2]Department of Biostatistics, Texas Heart Institute, Houston, Texas, USA; [3]Philips Medical Systems, Cleveland, Ohio, USA; [4]Department of Diagnostic Radiology, Baylor College of Medicine, Houston, Texas, USA.

Introduction: Contrast-Enhanced MRA (CE-MRA) continues to gain wide clinical acceptance for evaluating renal artery disease.[1] Recent studies have shown that when combined with fluoroscopic triggering, and centric phase encode ordering schemes, CE-MRA can be used to visualize renal arteries with good spatial resolution and minimal venous contamination.[2,3] The highest spatial resolution that can be obtained is constrained primarily by physiologic variables such as the arterial-to-venous transit time, and patient breath-holding ability.[2,3] In other words, the total number of phase encoding steps acquired within these constraints (in-plane (k_y) and through-plane (k_z)), ultimately determine the maximum achievable spatial resolution for a given coverage. Therefore, there is a need for traversing the k-space as rapidly as possible within these physiologic constraints. The traditional approach to traverse k-space faster is the use of high-performance gradients to reduce the echo time (TE), and repetition time (TR). It is also well known that such brute force reductions in TR and TE also adversely affect signal-to-noise ratio (SNR), and contrast-to-noise ratio (CNR) of CE-MRA.[4] In this respect, a recently described, parallel acquisition technique, Sensitivity Encoding (SENSE), traverses k-space faster by skipping phase-encoding steps by a factor proportional to the SENSE acceleration factor (ν).[5] The resulting intentional aliasing is removed with the knowledge of coil sensitivity profiles. This reduction in scan time due to SENSE acceleration can either be used to minimize potential patient motion by reducing breath-holding duration, or to increase spatial resolution by sampling farther in k-space during the same breath-hold duration.

Purpose: To directly compare (using qualitative, and quantitative metrics) two sequences, SENSE accelerated CE-MRA (SenCE-MRA) against conventional CE-MRA (ConCE-MRA), for evaluating renal artery stenoses. While both sequences were otherwise *identical* (including scan time), SENSE was used to improve the acquired spatial resolution of SenCE-MRA (before zero padding) by 67% compared to ConCE-MRA.

Method: *Patient Population:* 39 patients (18 male, 60±15 years) referred for renal artery evaluation were enrolled in this IRB approved study. All subjects gave voluntary, informed consent. *MRI Acquisition:* All imaging was done on a Philips 1.5T NT-Intera scanner using a 4-element phased surface coil for signal reception. Note that except for a 67% smaller voxel size for SenCE-MRA, all other acquisition parameters were identical (Table 1). *Contrast Administration Protocol:* 0.1 mmol/kg Gd-DTPA was used for each of the SenCE-MRA and ConCE-MRA acquisitions that were separated by 16±3 min. To minimize systematic bias due to residual contrast from the first scan, odd numbered patients had SenCE-MRA first, and even-numbered patients had ConCE-MRA first. *Data Analysis:* Quantitative metrics such as blood SNR, venous SNR, and the arterial to venous signal intensity ratio (AVR) were computed. Qualitative metrics assessed by an experienced radiologist included: (i) Proximal (Seg1), mid (Seg2), and distal (Seg3) renal artery (RA) image quality ranked on a scale of 1 (excellent) through 4 (poor); (ii) Artifact level measured by assessing Renal-Parenchymal blurring/ringing, RA ringing, and RA blurring on a scale of 1 (none) through 4 (poor); and (iii) reader confidence on a scale of 1 (very certain) through 3 (uncertain). *Statistical Analysis:* Statistical significance of qualitative metrics were assessed using a two-tailed t-test, and significance of quantitative metrics were assessed using a paired Wilcoxon signed rank test. A p-value of < 0.05 was assumed to reflect statistical significance.

Results: The results from the quantitative and qualitative analyses and their statistical significance are shown in Table 2.

Conclusions: Our results show that SENSE can be used to improve spatial resolution of CE-MRA renal arteries, despite the concomitant reduction in SNR. In addition, such improvement is accompanied by reduced venous contamination (i.e., higher AVR), improved image quality of proximal, mid, and distal renal artery segments, lower artifacts in renal parenchymal blurring, and renal artery blurring, and increased reader confidence. ●

Table 1. Acqusition Parameters of the ConCE-MRA and SenCE-MRA. Both Used Fluoroscopic Triggering and Centrically Encoded Acquisitions.

	ConCE-MRA	SenCE-MRA
Freq. FOV (mm)	448	448 x 448
Phase-FOV (mm)	358	448
Freq-Matrix	448	448
Phase-Matrix	314	448
SENSE Factor	1	2
# of Acq/Rec. Slices	30/60	30/60
Acq. Slice_thick (mm)	2.4/1.2	2.4/1.2
TE (msec)	1.2	1.2
TR (msec)	3.9	3.9
Flip (degrees)	35	35
BW/pixel (Hz)	434	434
Acq. Voxel (mm^3)	1x1.5x2.4	1x1x2.4
Rec. Voxel (mm^3)	0.88x0.88x1.2	0.88x0.88x1.2
Scan Time	30 sec	30 sec
SenSE Voxel/Con_Voxel		0.67

Table 2. Results and Their Statistical Significance of Quantitative and Qualitative Parameters: + Two-Tailed Student's T-Test; * Wilcoxon Signed Tank Test (Paired).

	SENSE CE-MRA	Conv CE-MRA	p-value
Quantitative Parameters			
SNR_{blood}	16.3+/-4.55	17.5+/-6.1	p=NS*
SNR_{vein}	3.34+/-1.73	3.37+/-1.78	p=NS*
AVR	8.98+/-6.21	5.85+/-7.27	p<0.04*
Qualitative Parameters			
RA Seg1 IQ	1.19+/-0.39	1.33+/-0.47	p<0.02*
RA Seg2 IQ	1.18+/-0.38	1.35+/-0.53	p<0.002*
RA Seg3 IQ	1.4+/-0.56	1.74+/-0.77	p<0.001*
Kid/Parenchymal IQ	1.69+/-0.79	2.46+/-0.98	p<0.001*
Renal Artery Ringing	1.01+/-0.11	1.04+/-0.19	p=NS*
Renal Artery Blurring	1.45+/-0.52	2.0+/-0.62	p<0.001*
Reader Confidence	1.11+/-0.35	1.45+/-0.61	p<0.001*

References

1. Prince M, et al. *J Vasc Surgery* 1995; 21:656-669.
2. Wilman A, Riederer S. *Magn Reson Med* 1997;38:793-802.
3. Fain S. et al. *Radiology* 2001;218:481-490.
4. Parker et al. *Magn Reson Med* 1998;40:873-882.
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Editor's Note: The President's Award was established to honor the most outstanding abstract submitted for the SMRT 13th Annual Meeting.

2004 SMRT Crues-Kressel Award

Luann Culbreth

2004 SMRT Honorary Membership Award

Emmanuel Kanal

2004 SMRT Distinguished Service Award

Kelly D. Baron

2004 SMRT Fellow of the Section Award

Heidi Berns

2004 SMRT Fellow of the Section Award

Carolyn Kaut Roth

Awards and Election Results Report

John A. Koveleski, R.T. (R)(MR), SMRT Past President, Nominations and Awards Committee Chair

It is the duty of the SMRT Past President to chair both the Nominating and the Awards Committees. It has been my pleasure to solicit SMRT members for positions on the Policy Board and Executive Committee and to receive names in consideration for special recognition awards.

The SMRT has several prestigious awards for SMRT members and supporters who have gone above and beyond the call of duty. It is my privilege to announce the following recipients. Elected by the SMRT membership to receive our ***Crues-Kressel Award,*** is **Luann Culbreth,** Dallas, Texas, USA. The SMRT Policy Board selected the following: ***Honorary Membership:*** **Emmanuel Kanal, M.D.,** Pittsburgh, Pennsylvania, USA; ***Distinguished Service:*** **Kelly Baron,** Union City, Indiana, USA; ***Fellow:*** **Heidi Berns,** Iowa City, Iowa, USA; ***Fellow:*** **Carolyn Kaut Roth,** Philadelphia, Pennsylvania, USA.

The SMRT Policy Board also selected the following officers to serve for three years: ***Treasurer:*** **Laurian Rohoman,** Montreal, Quebec, Canada; ***Secretary:*** **Gina Greenwood,** Madison, Wisconsin, USA; ***External Liaison:*** **John Koveleski,** Mechanicsburg, Pennsylvania, USA.

The Policy Board of the SMRT is made up of fifteen members. These members serve a three year term and each year, five members roll off after finishing their third year and five new members are elected. Each year a President-Elect is voted on by the membership. This individual also serves a three year commitment ending with the Past President position. Every three years the officers of Secretary, Treasurer, and External Liaison are selected by the Policy Board. Following the annual meeting in Toronto, many people expressed interest in serving on the Policy Board and getting involved in the Section. This resulted in a full slate of candidates. The results of the elections were recently announced and I would like to congratulate **Karen Bove Bettis,** Bethesda, Maryland, USA, our new President-Elect, and the following new members of the SMRT Policy Board: **Carolyn Bonaceto,** Boston, Massachusetts, USA; **Nancy Hill Beluk,** Pittsburgh, Pennsylvania, USA; **Bobbi Lewis,** Bethesda, Maryland, USA; **Mark Spooner,** Utica, New York, USA; **Wendy Strugnell,** Brisbane, Queensland, Australia.

These people have dedicated many years of hard work to fulfill the mission statement of the SMRT. Please join me in congratulating them. They will receive their awards at the Annual Meeting in May in Kyoto, Japan. I would also like to thank all of the candidates who were willing to run for these positions and encourage you to consider running again next year. Maureen Ainslie, current President, will chair these committees next year as Past President.

If you or any of your colleagues are interested in running for the Policy Board, please contact Maureen after the Kyoto meeting. Keep in mind; one does not need to be a Policy Board member to serve on a committee or become more active in the SMRT. For those of you who are members of the SMRT, you have the opportunity to serve on a committee and offer invaluable input to the chair of your committee. ●

President-Elect

Karen Bove Bettis

Treasurer

Laurian Rohoman

Secretary

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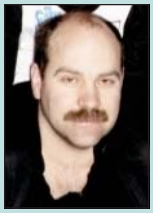

Mark Spooner

Wendy Strugnell

External Relations Report

Maureen Hood, M.S., R.N., R.T. (R)(MR)

"Radiologist Assistant (RA)"

The hottest topic for technologists today is the role of the advanced practice technologist. The American College of Radiology, (ACR) and the American Society for Radiologic Technologists, (ASRT) are working together to draft requirements and guidelines for advanced practice technologists. The current statement "The Radiologist Assistant: Improving Patient Care While Providing Work Force Solutions" can be viewed on the ASRT Professional Development webpage at https://www.asrt.org/. This is a first attempt to advance the role of the radiologic technologist in the clinical setting that has been supported by the ACR. However, the idea of advanced practice technologists is not new. There are a few Radiology Physician Assistants (PAs) in existence and Weber State University, in Ogden, Utah, USA, has had a program called "Radiology Practioner Assistant" since 1996. The United Kingdom has had an Advanced Technologist Program for many years. The recent shortage of radiologists has spurred the resurgence of the advanced practice technologist in the United States. The American Registry of Radiologic Technologists (ARRT) will offer the first certifying examination for RAs in fall of 2005. The US program will accept no grandfathering.

The ACR wants to set up a model for advanced practitioners that will be well received in clinical practice and that will not risk reimbursement. Several universities are currently working or have recently started on developing programs through grants from the ASRT: Loma Linda, Midwestern State University, University of Medicine and Dentistry of New Jersey, University of North Carolina at Chapel Hill, Virginia Commonwealth University, State University of New York at Syracuse, Ohio State University, University of Alabama at Birmingham, University of Arkansas at Little Rock, Quinnipiac University, and Northern Kentucky University. Most of these programs are or will be post-baccalaureate certificate or master's degree. An existing program at Weber State University has been instrumental in helping formulate the current draft guidelines and models.

What will RAs do? Advanced Radiographers in the UK fall under various specialties at the master's prepared level. Among the responsibilities of the Advanced Radiographer in the UK are: reading films and writing reports, conducting breast biopsies, peripheral contrast angiography, barium enema sessions, colonoscopies with biopsies, administering and prescribing medications, and ordering specific radiological exams (Peter Hogg, UK). The US program will be quite different due to the legal and professional differences in the US healthcare system.

In the US, the RA will be defined as: "A radiologist assistant is an advanced-level radiologic technologist who enhances patient care by extending the capacity of the radiologist in the diagnostic imaging environment. The radiologist assistant is an ARRT-certified radiographer who has completed an advanced academic program encompassing a nationally recognized radiologist assistant curriculum and a radiologist-directed clinical preceptorship. With radiologist supervision, the radiologist assistant performs patient assessment, patient management, fluoroscopy, and other radiology procedures. The radiologist assistant also makes initial observations of diagnostic images, but does not provide an official interpretation (final written report) as defined by the *ACR Standard for Communication: Diagnostic Radiology.*"

The RA in the US will be responsible for patient assessment, patient management, and patient education. The RA will perform selected radiology procedures such as dynamic and static fluoroscopy, and possibly cyst aspiration, needle biopsies, and lumbar punctures. The RA will also be responsible for evaluating image quality, making initial image observations, and communicating observations to the supervising radiologist. RAs will not do formal written reports or make diagnoses. The biggest area of concern is in the development of methodology for competency assessment. The programs will consist of a combination of didactic courses and a clinical practicum with a radiologist. It is expected that the actual roles of the RA will evolve over time. A curriculum has been drafted and can be viewed at http://www.asrt.org/other_categories/professional_dev/pdfs/2002RACurriculum %20Draft.pdf. It is also noted that the RA position may take longer to establish in some states since the laws in certain states must to be changed/modified to allow some of the proposed functions to be performed by a non-physician.

Why should MR technologists be interested in advanced practice? Although, the Radiologist Assistant role at this time is focusing on general radiography, it is the hope to set up models for advanced practice in all modalities/specialties some day. How MR is going to fit into this picture is yet to be determined. The SMRT is working to come up with ideas and plans to contribute to the formulation of the advanced practice MR technologist. MR technologists are encouraged to contact the ASRT to comment, and to insist that MR technologists have a major voice in the design of the MR advanced practice technologist. The ASRT is seeking public comment. Comments can be sent to Kevin Powers at: kpowers@asrt.org or to any members of the SMRT Executive Committee. ●

Report on the SMRT President's Regional Educational Seminar

Maureen Ainslie, M.S., R.T. (R)(MR), 2004 SMRT President

The SMRT President's Regional was held on Saturday, 18 October 2003, at the North Pavilion building on Duke University Medical Center Campus. The meeting focused on Advanced Imaging Technologies and their current applications.

The seminar began with an overview of *3T Imaging* by James MacFall, Ph.D., Co-Director of the Center for Advanced MR Imaging at Duke University. Dr. MacFall dispelled several of the myths regarding 3 Tesla imaging and gave insight into the benefits and challenges associated with this emerging clinical and research tool. Cecil Charles, Ph.D., Director of the Duke Image Analysis Lab and Co-Director of the Center for Advanced MR Imaging, followed with a review of *Current Clinical and Research Uses for MR Spectroscopy.* Following a break, Igor Klem, M.D., a researcher with the Duke Cardio-vascular Magnetic Resonance Center presented a thorough review of the *Core MR Cardiac Exam.* Aysenil Belger, Ph.D., a researcher in the Brain Image Analysis Center and the University of Chapel Hill, provided an overview of the *Potentials of Functional MRI* in the study of a variety of psychiatric disease processes.

SMRT President, Maureen Ainslie (left) and Anne Sawyer-Glover prepare for SMRT President's Regional Seminar.

Attendees are attentive as Dr. Belger explains Functional MRI.

Following a lunch break, Anne Sawyer-Glover, B.S., R.T. (R)(MR), from the Lucas Center at Stanford University, reviewed *Safety and Screening Policy and Procedures in an MR Environment.* Rendon Nelson, M.D., a Vice-chair of Radiology at Duke University Medical Center, reviewed *Contrast-Enhanced Abdominal Imaging.* The day ended with presentations from several vendors on *Advanced Imaging Capabilities.*

I would like to thank the local vendors who generously supported this Regional. Berlex Imaging, GE Medical Systems, MRI Devices Corporation, and Siemens Medical Systems provided support for breaks and lunch. This local support allows SMRT to continue to keep the cost of regional seminars affordable for MR professionals. I would also like to thank Kelly Hall and Yolanda Mejia from the Duke Image Analysis Lab for help in hosting this seminar. The meeting was well received by attendees. Some local residents left with the promise of hosting a seminar at University of North Carolina Chapel Hill next year. I look forward to seeing many North Carolina and Virginia MR technologists in the fall. ●

Report on the SMRT Northeast Regional Educational Seminar

Vera Miller, B.S., R.T. (R)(MR) and Karen Rich, R.T. (R)(MR)

The Northeast Regional Seminar was held Saturday, 25 October, at the Marriott Copley, in Boston. The topics for the one-day seminar were oriented to the new techniques and advancements in the field. A total of 81 people attended and the meeting went very well.

The morning session included a very informative presentation by orthopedic surgeon, Brian Busconie, M.D., who gave us a unique prospective on routine imaging in *Advantages of MRI in Sports Medicine.* Next up was George Holland, M.D., speaking on *Abdominal Imaging* with examples to show techniques and common pitfalls. Marc Flyer, M.D., lectured on various and interesting vascular procedures. The morning concluded with *Cardiac Imaging Anatomy and Pathology,* by Cindy Comeau, B.S., R.T. (N)(MR), who did a fabulous job of explaining how to obtain those beautiful two and four chamber views.

Northeast Regional (l. to r.) Co-Chairs, Karen Rich and Vera Miller are joined by SMRT President, Maureen Ainslie and speaker, Cindy R. Comeau, in Boston.

After an enjoyable lunch break, Daniel Sodickson, M.D., Ph.D., spoke on *Parallel Imaging.* His talk was well received and kept everyone's attention. Next up was Avishai Shapiro, M.D., speaking on *MR Spectroscopy, Diffusion/Perfusion.*

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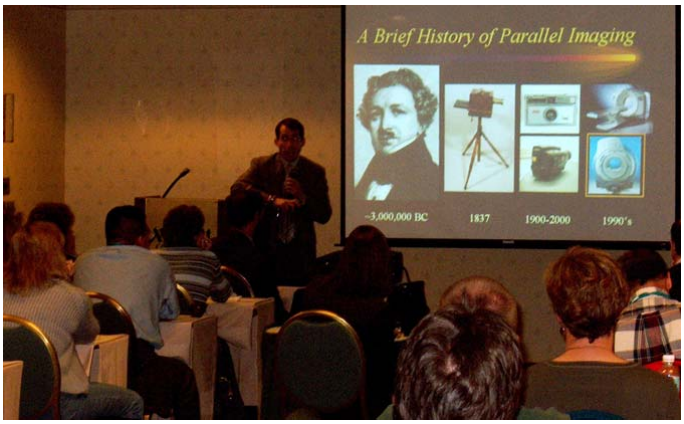


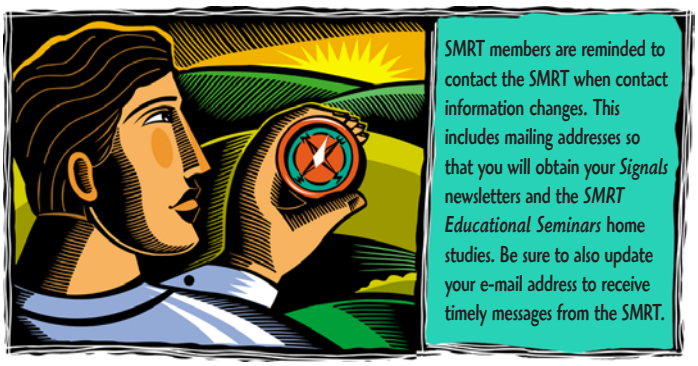
Presentation on Parallel Imaging by speaker Daniel Sodickson, M.D., Ph.D.

Concluding the seminar was a presentation by Gina Van Dootingh, M.D., about *Open MRI* and future trends. Feedback from attendees at the end of the day indicated they recognized and appreciated the overall great effort by all of the speakers. In spite of the beautiful weather outside, everyone felt their time was well spent inside at the seminar.

There were many MR technologists from a widespread area and it was great to be able to share different perspectives and ideas. The SMRT draws a variety of MR technologists from all aspects of the profession. It is a remarkable benefit! Having MDs, research scientists, application specialists, and technologists in the same room discussing techniques and procedures is a rarity. It was a great day!

We were honored to have in attendance both the current President (Maureen Ainslie) and Past President (John Koveleski) of SMRT. Maureen spoke briefly about the SMRT and the membership drive she is working on "Each One-Reach One." Members of the SMRT are only a fraction of the registered MRI technologists. Wouldn't it be great to build our membership to the point where we are truly a force in the healthcare world!

We would like to personally thank all the many Shields Health Care employees who helped. Shields Health Care sponsored this event and I am very grateful for their continued interest in technologist education. Thanks also go to Maureen Ainslie and Cindy Comeau for all their support. This is our first time to organize a seminar on this scale and it was a positive experience. We may try again next year! We learned a lot, but most of all it is wonderful to see so many technologists come out to further their education and learn new techniques. ●



SMRT members are reminded to contact the SMRT when contact information changes. This includes mailing addresses so that you will obtain your *Signals* newsletters and the *SMRT Educational Seminars* home studies. Be sure to also update your e-mail address to receive timely messages from the SMRT.

SMRT Northeast Regional Educational Seminar

Saturday, 20 March 2004, Bethlehem, Pennsylvania, USA

Linda Varnis, R.T. (MR)(R), Local Coordinator
Megan Mullen, R.T. (R) and Mark Perna, R.T. (R), Co-Chairs

Join us on Saturday, 20 March 2004, at St. Luke's Hospital in Bethlehem, Pennsylvania, USA. The seminar will take place in the Laros Auditorium, located in Physician's Building. The topics to be presented include *Cardiac MRI, Spectroscopy, Contrast Use at Low Field, Stroke Imaging, MRI Safety and Patient Management, Emergency Spinal MRI, Pituitary Imaging,* and *MR Planning for Gamma Knife Radiosurgery.*

This seminar is not only an excellent educational opportunity and a convenient way to earn ECE credits (7.5 hours of Category A CE credits are pending approval by the ASRT), it is also an opportunity to network with technologists from other MR sites in the area. Continental breakfast and lunch will be served as well as morning and afternoon coffee breaks.

PROGRAM 07.30 – 17.00

07.30 **Registration and Continental Breakfast**

07.55 **Welcome and Announcements**

08.00 **Emergency Spinal MRI**
Michael Rothman, M.D.
Bethlehem, Pennsylvania, USA

09.00 **MR Planning in Gamma Knife Radiosurgery**
George Chovanes, M.D., F.A.C.S.
Allen Neurosurgical Association, Inc., Bethlehem, Pennsylvania, USA

10.00 **Break**

10.15 **MRI Safety and Patient Management: Update 2004**
Frank G. Shellock, Ph.D.
Adjunct Clinical Professor of Radiology, Keck School of Medicine, University of Southern California and Institute for Magnetic Resonance Safety, Education, and Research, Los Angeles, California, USA

11.15 **Cardiac MRI**
Cindy Comeau, B.S., R.T. (N)(MR)
Cardiovascular Research Foundation, New York, New York, USA

12.15 **Lunch**

13.15 **MR Spectroscopy: Current Trends and Future Possibilities**
James. J. Stuppino, B.S., R.T. (R)(MR)
Director, Valley Advanced Imaging, Bethlehem, Pennsylvania, USA

14.15 **Stroke Imaging**
Ronald Sattenburg, M.D.
Director of Neuroradiology, Methodist Hospital, New York Presbyterian Health Care Center, Brooklyn, New York, USA

15.15 **Break**

15.30 **Use of Contrast Media at Low Field**
James. J. Stuppino, B.S., R.T. (R)(MR)

16.30 **Dynamic Pituitary Imaging**
Brian Hinz, R.T.
Chief Technologist CT/MR, Methodist Hospital, New York Presbyterian Health Care Center, Brooklyn, New York, USA

17.00 **Adjourn**

SMRT Eastern Canada Regional Educational Seminar

Saturday, 3 April 2004
Ottawa, Ontario, Canada

Rick Heroux, R.T. (R)(MR), Local Coordinator
Eric Murray, R.T. (R)(MR), Co-Chair

Attend the second SMRT Eastern Canada Regional Educational Seminar to be held at the University of Ottawa, Auditorium A & B, on 3 April 2004.

This eight-hour Category A ECE accredited program (pending approval by the CAMRT and ASRT) provides technologists with the opportunity to advance toward their educational goals. We are fortunate to have an outstanding faculty willing to donate their time and share their knowledge with SMRT members and other attendees. Topics to be presented are included below.

The seminar presents attendees with the chance to learn about cutting-edge developments in the field of MRI as well as the means to earn ECE credits. In addition, the event also serves as a backdrop for technologists to network among their peers from the surrounding area. A continental breakfast, lunch, and two coffee breaks will be served to further facilitate discussion.

PROGRAM 07.30 – 17.30

07.30 **Registration and Continental Breakfast**

07.55 **Welcome and Announcements**

08.00 **Imaging Trade-offs**
Leonard Avruch, M.D.
Ottawa Hospital, General Campus, Ottawa, Ontario, Canada

09.00 **New Pulse Sequences**
Michael Noseworthy, Ph.D.
St. Joseph's Hospital, Hamilton, Ontario, Canada

10.00 **Break**

10.15 **Body Imaging Techniques**
Dimitri Papadatos, M.D.
Ottawa Hospital, Civic Campus, Ottawa, Ontario, Canada

11.15 **Imaging at T3: Comparison to 1.5T**
Michael Noseworthy, Ph.D.
St. Joseph's Hospital, Hamilton, Ontario, Canada

12.15 **Lunch**

13.15 **Spectroscopy**
Maureen Ainslie, M.S., R.T. (R)(MR)
Duke Image Analysis Lab, Durham, North Carolina, USA

14.15 **Pediatrics**
Hal Dunlap, M.D.
Children's Hospital of Eastern Ontario, Ottawa, Ontario, Canada

15.15 **Break**

15.30 **CNS Pathology**
William Miller, M.D.
Ottawa Hospital, Civic Campus, Ottawa, Ontario, Canada

16.30 **Breast Imaging**
Jean Seely, M.D.
Ottawa Hospital, Civic Campus, Ottawa, Ontario, Canada

17.30 **Adjourn**

Congratulations to the MRI Devices Corporation 2003 Case Study Contest Winners!

Grand Prize
A trip to the SMRT 13th Annual Meeting in Kyoto, Japan on 14-16 May 2004

The winner is:

Michael Nagar from the Rutland Regional Medical Center in Rutland, Vermont, USA. *Case Study Submission: Breast with Interventional Localization and Biopsy.*

Second Place Prize
A trip to Las Vegas for a 2004 Northwest Imaging Forums conference, and a one year membership to the SMRT.

The winners are:

Karen Bakes from Erlanger Hospital in Chatanooga, Tennessee, USA. *Case Study Submission: Complete Pediatric Spine with Pediatric Array Coil.*

John Koveleski from Magnetic Imaging Center in Mechanicsburg, Pennsylvania, USA. *Case Study Submission: Capabilities of the 8 Channel High Resolution Head Array Coil.*

John S. McCloskey from Seattle Cancer Care Alliance in Seattle, Washington, USA. *Case Study Submission: Breast MRI and Biopsy with Interventional Device.*

Third Place Prize
A one-year membership to SMRT.

The winners are:

Karen Ziadie from Baptist Hospital, MRI Department in Miami, Florida, USA. *Case Study Submission: Breast Exam with Contrast.*

Norman T. Farrar from Beth Israel Deaconess Medical Center in Boston, Massachusetts, USA. *Case Study Submission: Non-Hodgkins Lymphoma of Breast.*

Todd Klinger from Magnetic Imaging Center in Mechanicsburg, Pennsylvania, USA. *Case Study Submission: Soft Tissue Neck, C-Spine, Brain with Neurovascular Array Coil.*

Barabara Lebron from Midstate Med. Center in Meriden, Connecticut, USA. *Case Study Submission: MRA/MRI of Hand with Small Extremity Array Coil.*

Thomas Cappas from Midstate Med. Center in Meriden, Connecticut, USA. *Case Study Submission: Breast Cancer Case, Open Breast Array Coil.*

Connie Lund from Midstate Med. Center in Meriden, Connecticut, USA. *Case Study Submission: Breast Cancer Case, Open Breast Array Coil.*

Bonnie M. Thursten from Seattle Cancer Care Alliance in Seattle, Washington, USA. *Case Study Submission: MR Guided Breast Biopsy Near Chest Wall.*

Catherine Leyen from SimonMed Imaging, Inc. in Scottsdale, Arizona, USA. *Case Study Submission: Mass Right Hand with Small Extremity Array Coil.*

Martha J. Taylor from Southwest Diagnostic Imaging Center in Dallas, Texas, USA. *Case Study Submission: MRI Guided Breast Biopsy, Open Breast Array Coil.*

Stephanie Hunter from The Imaging Center of Pensacola in Pensacola, Florida, USA. *Case Study Submission: Hand Mass, 8 Channel High Resolution Extremity Array Coil.*

Evelyn C. Proctor from University of California San Francisco in San Francisco, California, USA. *Case Study Submission: Unilateral Breast MRI, Invasive Ductal CA, Open Breast Array Coil.*

Welcome to the new pediatric section of *Signals*.

This column introduces a regular feature relating to specific aspects of scanning children which will now appear in *Signals*. The content of these articles will be provided by leading pediatric centres in Europe, North America, and the Asia Pacific region and will provide tips on how to successfully image children. This information may include protocol/pulse sequence options and case studies. We are keen to respond to all the questions you have regarding pediatric imaging so if you have an individual question or a request for this section please email me at michael.kean@rch.org.au

Pediatric MRI

Preparing the Infant for Brain MRI

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

In this issue we will cover immobilisation and hearing protection in children under six months of age undergoing brain examinations. The ultimate goal of any imaging program is to image very small children without the use of sedation, thus making the examination as minimally invasive as possible. Advances in MR technology have enabled vendors to develop MR systems so that scanners are more efficient and patient friendly, thus providing opportunities for clinical sites to develop strategies to scan younger patients without sedation.

The simplest form of immobilisation technique is to use Vac Fix® (available in Europe and North America) style devices that can be moulded to the fit the baby and combines sound attenuation properties and a robust immobilisation aide. Most sites use the 50 x 70cm (15 litre) bag for routine brain imaging. This device is inexpensive and can be used in all types of clinical and research studies in patients from the sickest babies through to routine outpatient scans. Depending upon the type of head coil used there may be a learning curve for successful and accurate placement of the baby in the bean bag but it is effective on all vendors systems.

Where possible, babies are fed prior to scanning, then the patients are swaddled in a light weight wrap, hearing protection applied and then allowed to settle in the bean bag prior to scanning (see photos below).
If an IV is required this should be inserted prior to feeding. Most sites that use this or a similar technique and have success rates approaching 98% for scans lasting up to 45 minutes. Some babies may take longer to settle and may require bookings close to normal sleep times so it is wise to consult the parents prior to scheduling.

As with all types of imaging, safety is a key component to the successful completion of any examination and as such we must be aware of potential for cross infection as this is a multiuse device, a minimum requirement for pulse oximetry during the

Continued on page 13

scan and the requirements of thermoregulation. As the baby is theoretically contained within a polystyrene mould there is a potential to increase the baby's core temperature so we must be aware of the implications of using high SAR sequences.

The other key factor of patient safety relates to hearing protection. New advances in gradient technology and pulse sequence design at high-field have enabled pulse sequences that maximise the system's gradient capabilities to limit the acoustic exposure to below 100dB. Infants tend to be more settled in a quiet environment so methods of attenuating the acoustic signature of the MR should also be employed. Unfortunately some of the methods employed in adults, ear plugs and ear muffs are not always successful in children and may be difficult to adequately position within an immobilisation device. Hearing protection devices such as disposable ear plugs are often ineffective due to air leaks, plug dislodging during the examination and ear muffs not fitting adequately. The best results are obtained when both types of sound conduction are addressed– air and bone. In babies and small infants the best method for attenuating the air conduction pathway is to use commercially available soft ear putty (silicone based) and for the bone transmission an adhesive ear muff such as Mini-Muff (Natus Medical, California, USA). The Mini-Muff only has a maximum attenuation of 7dB but when used in combination with soft moldable substances plus the attenuation properties of the immobilisation device dramatically reduce the potential risk of hearing impairment. Large pediatric institutions often have customised systems that may include music but these are not often available to the general MR community. ●

LOW- AND MID-FIELD MRI

Precessing in a Vertical Field: Throughput on a Low-Field System (Part 2)

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

In the last issue, I wrote about tailoring the study to meet the clinical need. Now I'd like to address issues that may, or may not be under your direct control.

I'm often asked about what one should expect for reasonable throughput. My response is to say that, in my opinion, the major issue that impacts throughput is the time the table is empty between patients. Many sites have limited the number of technologists to one per magnet and the only other staff member may be the receptionist out front. In such a situation, I don't think it's reasonable to expect any more than one patient per hour, particularly on a low field system. In fact, based on some protocols I've seen, that may be tight on a high field system.

The first problem occurs when the MR techologist has to get the next patient ready. For obvious safety and patient care reasons, at no time should the technologist be required to leave a patient in a scanner unattended while they prepare the next patient or perform clerical tasks. In many instances, the job of screening the patient has been given to the receptionist. If the receptionist is the primary person to screen the patient, they should be fully trained and therefore the site should have a defined program for doing so. They should be given a "tune-up" inservice in MR safety at least annually.

In any event, the MR technologist still has the responsibility for insuring the patient has been adequately screened. Nothing can replace talking with the patient. Simply giving them the sheet and saying, "here, fill this out" won't cut it. When a technologist takes time to sit and interview the patient, they get the opportunity to answer questions the patient may have and also put them at ease by showing the procedure will be performed by a caring and knowledgeable professional. This can be particularly important when dealing with patients who may be a bit on the anxious side to begin with.

The second issue that can occupy a technologist's time, is often the paper work required after a scan is completed. If the site still films (I look forward to the day when a student asks, "what is film?"), then the technologist has to gather the films, often number them, put them together with the request and previous films (probably having had to find them), and then, perhaps even hang them for the radiologist.

If the site has only one technologist to deal with preparing the patients and completing the clerical functions that follow a scan, then the table can be empty up to 20 minutes between patients. My point is not to say that a site should have two technologists per scanner at all times, but if not, they should have adequate ancillary personnel who are well trained in MR safety and patient care. It seems to me that if a site would hire one or two technologist assistants, the trained MR technologist could still talk with each patient prior to each study and that empty-table time can be reduced to as little as 5 minutes. Take 15 minutes multiplied by 10 patients and you have time for at least 3 more patients in the same number of available work hours.

MR sites should look more closely at the organization of their staff rather than taking the easy way out and just minimizing the number of employees. ●

MRI SAFETY

Cardiac Pacemakers: Growing Evidence for MRI Safety

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

The presence of a permanent cardiac pacemaker has represented a strict contraindication to magnetic resonance imaging (MRI). The electromagnetic fields (static, gradient, and radiofrequency fields) used for MRI may cause harm to patients and are generally believed to be potentially detrimental to the function of pacemakers. Proposed adverse interactions between cardiac pacemakers and MRI include excessive heating, possible movement of the device, induction of inappropriate pacing, inhibition of pacing output, alteration of programming with potential damage to the pacemaker circuitry, reed switch malfunction, as well as other unwanted interactions.

Harmful effects to patients with cardiac pacemakers in relation to MRI have been documented. To date, approximately thirteen fatalities have been attributed to cardiac pacemakers in association with the MRI environment. In virtually every case, however, the patient apparently entered the MRI environment without the staff knowing a cardiac pacemaker was present. Importantly, these deaths were poorly characterized, no electrocardiographic data were available for review, it was unknown whether these patients were pacemaker dependent, and no mention was made regarding the actual cause or mechanism of death. By comparison, no irreversible harm has been reported when patients with cardiac pacemakers were carefully monitored during MRI procedures and/or the devices underwent reprogramming prior to the scans.

Regardless of the known hazards of subjecting a patient with a cardiac pacemaker to the MRI environment, numerous patients (200+) have undergone MRI during purposeful, monitored procedures that were performed in order to conduct necessary diagnostic examinations. These patients were safely and successfully imaged using MR systems operating at static magnetic fields ranging from 0.35- to 1.5-Tesla without any clinically adverse events.

In the majority of these studies, the investigators carefully followed specific strategies designed to safely perform MRI procedures. These strategies included programming the cardiac pacemaker to sub-threshold or an asynchronous mode, programming to a bipolar lead configuration (if possible), only imaging non-pacemaker-dependent patients, and limiting the RF power exposure during MRI (including using only send/receive RF coils for head-only or for extremity-only MRI examinations). Careful monitoring by appropriate healthcare professionals was implemented in each case along with other precautions to ensure patient safety. One important precaution was to have an advanced cardiac life support (ACLS)-certified physician present throughout the examination. This physician was aware of MRI-related safety issues for cardiac pacemakers and capable of recognizing and managing any untoward consequences. Resuscitation equipment was also available in close proximity to the MR system room.

Recently, two studies have addressed MRI safety for cardiac pacemakers. A laboratory investigation conducted by Roguin et al. (2003) studied the effects of MRI performed at 1.5-Tesla on "modern" cardiac pacemakers. MRI-related heating, magnetic field interactions, image artifacts, and the effects of MRI on the functional aspects of the pacemakers were evaluated. The investigators concluded that modern cardiac pacemakers may be MRI-safe.

In a soon to be published study by Martin et al. (*Journal of the American College of Cardiology,* 2004), one of the largest non-pacemaker-dependent patient populations with permanent cardiac pacemakers underwent MRI procedures at 1.5-Tesla. In order to examine potential risks in the broadest possible population, no restrictions were placed on the anatomy that underwent imaging, the type of pulse sequence or conditions used for MRI, nor on the type of pacemakers present in the patients in this investigation. Only pacemaker-dependent patients were excluded (with the exception of one patient that inadvertently underwent MRI) to eliminate problems if pacing was inhibited during the MRI procedures.

Importantly, cardiologists monitored the patients, Advanced Cardiac Life Support (ACLS)-trained personnel were present during the examinations, and resuscitation equipment was readily available if problems arose for these patients.

The findings in the study by Martin et al. indicated that patient symptoms were mild and transient and did not lead to discontinuation of the MRI examinations. Significant alteration of the pacing threshold was found in a small number of leads tested. These threshold changes required a programmed output change in only two leads and were of no clinical consequence.

Martin et al. concluded that, because of the infinite possibilities of pacing systems, cardiac and lead geometry, as well as variable static, gradient, and RF electromagnetic fields and conditions used for MRI procedures, the absolute safety of pacemaker and MRI interactions presently cannot

Continued on page 15

be assured. However, given appropriate patient selection as well as continuous monitoring and preparedness for resuscitation efforts with ACLS-trained personnel in attendance, performance of MRI procedures in non-pacemaker dependent patients may be achieved with reasonable safety even at static magnetic field strengths of 1.5-Tesla with an acceptable risk/benefit profile. It should be noted that the findings described by Martin et al. are highly specific to the MR system, software version running on the scanner, MR imaging conditions, and types of pacemakers and lead systems that were present in the patients.

In consideration of the above, there appears to be growing evidence from *in vitro,* laboratory, and clinical studies that strict restrictions prohibiting MRI procedures in patients with "modern" cardiac pacemakers may be modified in the near future. Similar to performing MRI procedures in patients with other electronically-activated devices (e.g., bone fusion stimulators, cochlear implants, neurostimulation systems, etc.), scanning patients with cardiac pacemakers will involve following highly specific procedures to ensure patient safety. ●

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