

Signals

NEWSLETTER OF THE SECTION FOR MAGNETIC RESONANCE TECHNOLOGISTS

Number 67
2008 Issue 4



SMRT President's Message



"In this increasingly difficult time of the world economy we understand our members need to access education as cost-effectively as possible."

Wendy Strugnell, B.App.Sc.(MIT)

In this Issue

3 Editor's Letter

Membership News

3 Reminder to Vote

4 MR Curriculum

4 Call For Papers

6 2009 Annual Meeting Update

Local, Regional, Global Reports

8 Chapter Chat

9 SMRT Regional Updates

9 Northeast Ohio

10 Koveleski Memorial

11 Northwest Regional

Information for You

12 Educational Seminars Update

14 Scanning Infants at 3T

16 MRI Safety-Infection Control

Upcoming Programs

24 Calendar of Educational Opportunities

A Global Learning Community

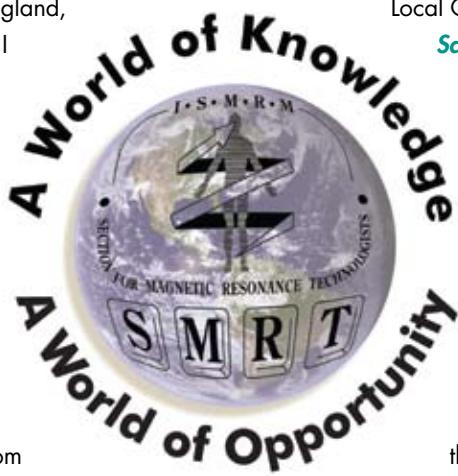
"A world of knowledge, a world of opportunity" is the slogan on our SMRT globe logo. It is an accurate reflection of the SMRT as our society expands and develops an increasingly global presence. The current SMRT Policy Board is representative of this with members from Australia, Belgium, Canada, England, Malta, and the USA. I hope those of you fortunate enough to attend the 17th Annual Meeting in Toronto this year made the most of the opportunity to meet and interact with your professional peers from the many diverse countries in attendance.

It was wonderful to read, in the last edition of Signals, about the two successful educational meetings in Europe (Belgium and Denmark). Thanks to the enthusiasm and hard work of dedicated SMRT members we are reaching out and expanding into new parts of the world and achieving Goal 1.1 of our strategic plan: "Foster the development of a global learning community." The success of the meeting in Belgium has enabled *Filip de Ridder*, our

Membership Committee Chair, to establish the first SMRT Local Chapter in Europe. The BeNeLux Chapter will serve the MR technologists of Belgium, the Netherlands and Luxembourg. Congratulations to Filip and his office bearers, *Sandra van den Berg* and *Raschel van Luijk* (both from Amsterdam) for achieving this. Our new Chair of the Local Chapter Committee, *Ashok Saraswat* has been working hard in his new role and has also facilitated the establishment of the New York and New Jersey Chapter with *Hina Jaggi* as President. The SMRT leadership looks forward to supporting new Chapters to meet the educational needs of their members.

New Web-based Educational Opportunities

The SMRT is always focused on providing the best educational opportunities for MR technologists and radiographers. In this increasingly difficult time of the world economy we understand our members need to access education as cost-effectively as possible. The SMRT Educational Seminars Home Study program is a fabulous way to keep up-to-date with our ever-changing field and earn on-going education credits without leaving home. In an effort to provide faster



access to educational credits, starting with the latest seminar "Head and Neck MRI at 3T," you will be able to take the quiz on-line and have your certificate e-mailed back to you. For our ANZ members please note that the Home Study program is accredited by the Australian Institute of Radiography and the New Zealand Institute of Medical Radiation Technologists.

In addition to the popular quarterly hard-copy Home Studies mailed to members we are now delivering regular Electronic Home Studies which will only be available only online. We are grateful to **Dr. Frank Shellock** for providing the first SMRT Electronic Home Study, "Safety of Magnetic Resonance Imaging in Patients with Cardiovascular Devices." None of this would be possible without the efforts of our indefatigable Home Studies Editor, **Anne Marie Sawyer** whose dedication, persistence and initiatives continually drive the SMRT forward. I would also like to thank the ISMRM staff Sally Moran, Mary Keydash, Jennifer Olson, Jennie Moreau-Cook, and Allison Barbour for making this possible for our members.

The President's Regional Meeting

As those of you in the northern hemisphere are packing away your summer clothes, think about putting some in a suitcase and joining your southern colleagues in the beautiful city of Sydney, Australia for the first President's Regional Meeting to be held outside the USA. **Michael Macilquham**, the ANZ Chapter President, and the local co-chairs **Kirsten Moffat** and **Gloria Olivieri** have put together an exceptional program with keynote speakers **Dr. Elizabeth Moore**, **Dr. Michael Moseley**, and **Dr. Frank Shellock**.

This is the third annual meeting of the ANZ Chapter and will be held 15 and 16 November at the Sydney Convention and Exhibition Centre. If you aren't able to travel that far be sure to check the website regularly for upcoming meetings closer to home. www.ismrm.org/smrt/CEopp.htm

MR Curriculum

By now you will be aware that the multi-agency MR Curriculum Guide 2008 is available at www.ismrm.org/smrt. This document was created for the purpose of providing a nationally recognized, entry-level MR imaging curriculum that included didactic and clinical competencies. While this document was written to guide USA educational institutions in the formation and revision of MR technologist programs, I would like to recommend its value to all educators and those with supervisory responsibilities, wherever you may practice. Recently I was required to write core skills competencies for all the staff levels in my department and I found this very comprehensive document incredibly useful. It is hard to conceive the number of hours that it took to produce the guide and I hope that many people find it as valuable as I have. My extreme gratitude goes to the dedicated group of people who created the guide.

SMRT Policy Board and Executive Committee Activities

The SMRT Policy Board had a face-to-face meeting in Toronto in May. This year we started the meeting two hours earlier than usual as there is always so much business on the agenda. As well as dealing with ongoing issues, this meeting is an opportunity for the leadership to define the goals for the year and for the board members to discuss their ideas. This is always a time of great enthusiasm and energy and of course the challenge is to maintain that level of involvement when everyone goes home to their busy lives! So far the Policy Board members are excelling themselves with staying focused and working hard on the numerous committees they are either serving on or chairing and I thank them for their dedication.

Since May, the Executive has met four times by teleconference, on two occasions with the Program and Education Committee Chairs to facilitate planning for the SMRT

18th Annual Meeting. One meeting was held with the Chairs of each Standing Committee to provide feedback on their various activities. The Policy Board and the Executive are here to serve the needs of the membership so if you have any feedback or suggestions please email me at wendystrugnell@internode.on.net

SMRT 18th Annual Meeting in Hawai'i 2009

How fortunate we are to be able to return to beautiful Honolulu for our Annual Meeting in April 2009. Those of you who attended the meeting in 2002 will know that the venue is magnificent and the setting just a little bit distracting! The Program Committee chaired by **Ben Kennedy** has been working extremely hard to put together a program which will entice you away from the beach. With the theme "Evolution of MR Innovation" you can expect a weekend full of inspiring yet practical education. If you are doing something innovative in your workplace why not share it with your peers and submit an abstract. Our industrious Education Chair, **Sonja Robb-Belville** would be happy to provide information and guidance if required (srobbbe@emory.edu).

Make sure you take advantage of the reduced meeting fees for SMRT members and stay on for the ISMRM 17th Scientific Meeting and Exhibition for even more of the latest innovations in our professional field.

Elections for Policy Board and President-Elect

Last but not least, please remember to have your say in the future leadership and direction of our society by completing your ballots and sending them in on time. If you are a non-voting member and would like to change your status to a voting member please contact Kristina King, Membership Director at kristina@ismrm.org. 



Editor's Letter

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

Greetings,

As 2008 winds down we can all look back and note the up and downs

of this year. One of the ups is certainly the dedication and efforts of the members and leaders of the SMRT to improve and advance this organization. We begin this quarterly issue with an update from SMRT President, **Wendy Strugnell**. Nominating Committee Chair, **Carolyn Bonaceto**, reminds YOU to vote for the future leaders and policy makers of the SMRT.

Sonja K. Robb-Belville, Education Committee Chair announces the MR Curriculum guide now available and the "Call for Papers." The 2009 Annual Meeting is nearly finalized as described by **Ben Kennedy**, Program Committee Chair.

The many educational activities of the SMRT are reported, beginning with Chapter Chat by Local Chapters Committee Chair, **Ashok Saraswat**. **Kris Barnhart** reports on the successful meeting of the Northeast Ohio Chapter. **Janice Fairhurst**, Chair, Regional Seminars Committee lists the various educational seminars, recent and upcoming. Be sure to check if there is one near you to take advantage of these quality MR programs. Co-Chairs, **John Posh** and **Robin Klein** give a pictorial review of the second annual SMRT John Koveleski Memorial Regional Seminar.

The latest presentation of the SMRT Educational Seminars Home Study Program is offered by **Anne Marie Sawyer**, as well as new on line learning for continuing education credit. SMRT member **Satia Shova** shares her experience with scanning infants

at 3 Tesla. Rounding out this issue is guest contributor **Peter Rothschild** who shares important information about infection control in the MRI environment.

You are reminded to check the calendar of upcoming events and be sure to check on the SMRT web-site for up to date information between quarterly issues of Signals. Your suggestions and contributions are welcome at jpeay@wi.rr.com. Please include SMRT Signals in the subject line

Happy Reading!



Important Notice: Remember to Vote

**Carolyn Bonaceto, B.S.,
R.T.,(R)(MR)
Chair, Nominating
Committee**

"You once again have the opportunity to help choose the leadership of the organization that will drive the changes for the worldwide MRI Technologist/Radiographer community for years to come."

Ballot Deadline:
Ballots must be postmarked no later than 1 December 2008

It's that time of year again. The election for your SMRT Policy Board and President Elect is right around the corner. You once again have the opportunity to help choose the leadership of the organization that will drive the changes for the worldwide MRI Technologist/Radiographer community for years to come. Don't miss out on your chance to be heard. In general, the number of members who vote is quite small. We understand that some people find it difficult to mail their ballots to the SMRT office. Due to issues associated with our incorporation, we are not able to offer electronic ballots online at this time. Rest assured that the issue is

acknowledged and that discussions around improving this situation are active. But please try to make an effort to mail in your ballot. The Nominations Committee has selected an impressive list of qualified candidates. I am honestly not sure how I will pick just five. Please review the biography that is provided for each candidate and choose the candidates you feel best represent you and your colleagues. In addition to the Policy Board candidates, you will be helping to select the President Elect who will follow Pam Vincent as President of the SMRT. Again you will find the choice difficult. Each candidate has demonstrated years of dedication to the

SMRT and to you. They have each taken on leadership roles, organizing meetings and chairing committees. Anyone of them will make an exceptional President. But it's up to you to decide. The SMRT exists for you, because of you. In order to keep the momentum established over the years, your participation is essential. Please make it a priority to take some time from your busy schedule. Make an informed decision and help keep SMRT moving and growing in the future. Get your ballot in, YOUR vote matters!

Messages from the Education Committee



Sonja K. Robb-Belville
B.S., R.T., (R)(MR)
Chair, Education Committee

MR Curriculum is Now Available

In May 2005, at the 14th Annual Meeting of the SMRT in Miami, Florida, USA the Ad Hoc Education Standards Committee was formed. This was in response to the American Registry for Radiologic Technologists' (ARRT) call for feedback from the industry, as they explored the creation of a primary pathway credentialing opportunity for candidates to enter the Medical Imaging field directly as Registered Technologists (RT's) in Magnetic Resonance (MR). Since then, the committee has been working diligently to establish and define the educational standards for MR technologists. In January 2006, the ARRT implemented the primary pathway certification method that had been proposed.

Members of the SMRT Ad Hoc Education Standards Committee provided feedback prior to the implementation by reviewing the content specifications for the exam itself, as well as the clinical competency requirements to gain registry eligibility. In May 2006, at the 15th Annual Meeting of the SMRT in Seattle, Washington, USA, the SMRT hosted a Summit on MR Education Standards. This multi-agency effort brought together the SMRT with the ARRT, the American Society for Radiologic Technologists (ASRT), the Association of Educators in Imaging and Radiologic Sciences (AEIRS), and the Joint Review Committee on Education in Radiologic Technology (JRCERT) in a unified mission to create a nationally

recognized, entry-level MR imaging curriculum that included didactic and clinical competencies.

We are pleased to announce that the multi-agency MR Curriculum Guide 2008 is now available through the link below, in both MS Word and Adobe Acrobat formats. This curriculum document is intended to guide educational institutions in the formation and revision of MR programs. It is recognized by the JRCERT and ARRT as an acceptable mechanism to ensure that program graduates meet the necessary cognitive, psychomotor, and affective skills of a registered technologist. Link to the MR Curriculum Guide: <http://www.ismrm.org/smrt/mri.htm>.

“Call for Papers” 18th Annual Meeting, Honolulu Hawaii

The Program and Education Committees invite abstract submissions to be presented in oral and poster sessions at the SMRT 18th Annual Meeting “Evolution of MR Innovation.” Submissions will only be accepted from people practicing as MR Technologists, Radiographers or equivalent and must be their own original work that has not been previously presented or published.

The 18th Annual Meeting of the Section for Magnetic Resonance Technologists is being held 18 & 19 April 2009 in beautiful Honolulu, Hawaii, USA. We think that you will agree, this location is the perfect backdrop for the 2009 meeting and its theme, “Evolution of MR Innovation.” We hope you are making plans to attend!

The Chairs of the SMRT Program

and Education Committees are pleased to announce the “Call for Papers” for this meeting. The SMRT is committed to promoting the dissemination of information regarding current and emerging technological advances to our members. The SMRT has set a precedent around the world for providing quality educational opportunities for Magnetic Resonance Technologists and Radiographers. Previous program evaluations and suggestions were used to guide the content and speakers chosen for this meeting in an effort to provide a forum for education, information, and research. The program will include a variety of topics geared to enhance your knowledge in the field of Magnetic Resonance.

Important components of the meeting continue to be the Proffered

Papers and Poster Presentations in the clinical and research focuses submitted by MR Technologists and Radiographers. The Friday evening Poster Walking Tour and Reception provides a pleasant way for attendees to interact while discussing innovative clinical applications and cutting edge research. Poster authors will be available to discuss their work and answer questions. This event provides an excellent opportunity for networking with MR professionals from around the globe!

The two-day annual meeting program schedule includes current, pertinent information that will be presented by leading, international MR professionals. The SMRT Business Meeting will be held prior to lunch on Saturday, and awards for the most outstanding papers



Hawaii Convention Center, Honolulu, Hawaii, USA

Honolulu

Section for Magnetic Resonance Technologists

18th Annual Meeting

18-19 April 2009

Hawai'i

and posters in the clinical and research focuses will be presented on Sunday. The SMRT welcomes all MR Technologists and Radiographers whether from a clinical, research, veterinary, or industrial setting to attend. The meeting is intended for those who wish to be active and get involved and for those that like to just sit back and take it all in.

In the Hawaiian Language, Honolulu means "place of shelter," where the fresh air energizes you, the warm tranquil waters refresh you, and the breathtaking natural beauty renews you...There's no place on earth like Hawaii. On the island of Oahu, nicknamed "the gathering place" cultures from the east fuse with the west, all rooted in the traditions and values of the native Hawaiians. You'll enjoy lush mountainsides minutes away from the soaring cityscape. Trade in your suit & tie or scrubs for casual dress clothes and resort wear. Join us for a weekend of innovative education while enjoying Honolulu. Aloha!

Please visit our website for updates and program information:
<http://www.ismrm.org/smrt>

2009 ABSTRACT SUBMISSION PROCESS

We wish to invite people practicing as MR Technologists, Radiographers or equivalent from around the world to submit abstracts for presentation in oral and poster sessions at the 18th Annual Meeting. The deadline for submitting abstracts is 7 January 2009. Abstracts must be submitted electronically via the ISMRM/SMRT website: <http://www.ismrm.org/smrt>. Detailed instructions will be posted on the website and abstracts must be submitted according to these instructions. Topics may describe innovative clinical

applications or address novel research. The seven (7) top scoring oral abstracts will be selected for presentation and win awards All other accepted abstracts will be invited to present their work as a poster. If poster authors wish to have their poster judged for an award they must submit an electronic poster by 23 February 2009. Instructions for the electronic submission of posters are available on the website and must be followed explicitly for the successful handling of files. There will be examples of posters on the website for your reference. A small number of poster presenters will be selected to present orally at the SMRT Poster Walking Tour and Reception on Friday evening, 17 April 2009.

ABSTRACT SUBMISSION GUIDELINES

Abstracts in the clinical focus must include sections on the background or purpose of the research, the teaching point, and a summary. Research abstracts should state the purpose of the research, outline the methods, summarize the results, and finally, discuss the conclusions from the results. All abstracts submitted by the author for Oral or Poster Presentation which meet the acceptance criteria after committee review may be displayed as a poster. After being reviewed and scored by the Education Committee, seven (7) of the abstracts submitted for Oral Presentation will be selected to receive a Proffered Paper Award. The remaining abstracts reviewed that meet the acceptance criteria may be submitted for scoring as a poster. In completing the request for address information on the abstract submission form, it is necessary that you list the presenter's name, degree(s), preferred mailing address, e-mail, and telephone/fax numbers. The SMRT Abstract

submission must be completed in its entirety or the submission will not be considered. Accepted abstracts will be published in the SMRT Annual Meeting Syllabus. Abstract Submission Withdrawal: Written requests for withdrawal must be received by 13 February 2009 at the ISMRM/SMRT office, 2030 Addison Street, Suite 700, Berkeley, CA 94704, USA.

PRESENTATION INFORMATION

The authors of the abstracts accepted for poster presentations are required to attend the SMRT Reception and Poster Walking Tour on Friday evening, 17 April 2009. The authors of abstracts accepted for oral presentations are required to present their paper at the scheduled day and time. All oral and poster presenters will receive detailed instructions and information pertaining to their presentations with their acceptance letters.

AWARDS

The President's Award: The President's Award was established to honor the most outstanding abstract submitted for the SMRT 18th Annual Meeting. The recipient of this award must present his or her work as an oral presentation. The honoree will receive an educational stipend in recognition of the presenter's award-winning abstract at the SMRT 18th Annual Meeting. Other Awards: Additional awards will be presented to the next highest scored submitted abstracts. These awards are as follows: (1) Research Focus – Oral Presentation: 1st, 2nd, and 3rd; (2) Research Focus – Poster Presentation: 1st, 2nd, and 3rd; (3) Clinical Focus – Oral Presentation: 1st, 2nd, and 3rd; (4) Clinical Focus – Poster Presentation: 1st, 2nd, and 3rd.



**Ben Kennedy, B.Sc.,
Chair, 2009
Program Committee**



**Sonja K. Robb-Belville,
B.S., R.T., (R)(MR)
Chair, 2009
Education Committee**

2009 Annual Meeting Update

"Two of the most regarded and effective components of the meeting continue to be the proffered papers and poster presentation. We widely encourage technologists from around the world to submit abstracts for oral or poster presentation."

SMRT 18th Annual Meeting "Evolution of MR Innovation"

The Program and Education Committees would like to invite technologists from around the world to attend the 18th Annual Meeting of the Section for Magnetic Resonance Technologist. Our meeting will be held 18th -19th of April 2009 in conjunction with the 17th Scientific Meeting and Exhibition of the International Society for Magnetic Resonance in Medicine at the Hawai'i Convention Center, Honolulu, Hawai'i, USA. The goal of the SMRT is to provide quality educational opportunities for the MR technologist/radiographer and to establish and maintain a high level of professionalism in the field.

Two of the most regarded and effective components of the meeting continue to be the proffered papers and poster presentation. We widely encourage technologists from around the world to submit abstracts for oral or poster presentation. The poster exhibition and walking tour will be a key event on Friday evening prior to the weekend program. This is a great opportunity to meet other registrants and see the outstanding standard your colleagues are producing both in scientific and clinical environments. The meeting program allows for seven oral presentations. These presentations will be made by the authors of the top scoring abstracts. The top overall score receives the President's Award; first, second, and third

place in either clinical or research will be awarded as well. Abstracts that are not selected for an award and oral presentation may then submit a poster electronically for poster award consideration. Poster awards include first, second, and third in each category, clinical or research. Abstracts with either a clinical or research focus will be accepted until 7 January 2009. Online abstract instructions and submissions will be available on the SMRT website: <http://www.ismrm.org/smrt>.

This program offers a diverse range of forums including MR technology updates, safety, 3T, abdominal, paediatric, neuro, and emerging technologies such as molecular, ultrashort TE (UTE), and lung imaging. The SMRT Business Meeting will be held before lunch on Saturday. The Business Meeting is an open session for members to attend and learn what the SMRT is doing to further its mission and goals. Members can observe the activities of the SMRT over the previous year and the goals for the upcoming year. All members of the Policy Board and Executive committees are introduced. This is an important part of the meeting where you as a member get to voice your questions/opinions to the Policy Board and Executive members. Your attendance and interaction at this meeting is invaluable to the SMRT in continuously improving our networking with our membership and allowing the SMRT to increase its ability to evolve further as a

global resource of MR education. Sunday afternoon awards will be presented to our members who have helped fulfil the SMRT's commitment to excellence in MR education. Awards will also be presented to the authors of the most outstanding papers and posters in the clinical and research focus area.

Please be sure to attend the SMRT and ISMRM Joint Forum presentation which will be held at 14:00, Monday, 20 April 2009. Your registration for the SMRT Annual Meeting allows you to attend this forum. This year the forum topic is titled "How to Perform a Multi-site Neuro-imaging Study," organized by Gary H. Glover, Ph.D., Bryon A. Mueller, Ph.D., Caron Murray, MRT(R)AC(CT(MR)), and Douglas C. Noll, Ph.D. The joint forum, by design, is a grand collaboration of energy and talent between the ISMRM and the SMRT which continuously promotes the highest quality of education in the MR world.

The SMRT was established to provide superior educational opportunities for technologist/radiographers as well as a forum for members to collaborate with and learn from each other. The 2009 Annual Meeting is dedicated to providing these numerous important tools. On behalf of the 2009 Program and Education Committee Chairs, we are pleased to invite you to join us in Honolulu for a celebration of evolution of MR innovation.

SMRT 18th Annual Meeting "Evolution of MR Innovation"

Program Schedule "Evolution of MR Innovation"

SMRT Poster Walking Tour Reception – Friday, 17 April 2009, 6:00 pm

Time	Saturday, 18 April, 2009	Time	Sunday, 19 April, 2009
07:00	Registration	07:30	Registration
07:45	Welcome & Announcements Wendy Strugnell, BAppSc (MIT), SMRT President 2008-2009 Ben Kennedy, BAppSc (MIT) MMRT, SMRT Program Chair 2009	07:45	Welcome & Announcements Pam Vincent, MPA, R.T., (R)(CT)(MR), SMRT President 2009-2010 Ben Kennedy, BAppSc (MIT) MMRT, SMRT Program Chair 2009
	Moderator: Jane Francis, DCR, (R) DNM		Moderator: Sonja Robb-Belville, B.S., R.T., (R) (MR), SMRT Education Chair 2009
08:00	MRI Physics and Technology Forum Understanding K-Space: An Intuitive Approach Donald Plewes, Ph.D. Overview of MR Pulse Sequences William Faulkner, B.S., R.T., (R)(MR)(CT)	08:00	Pediatric MRI Forum Pediatric Scan Optimization Floyd Knight, R.T. (R)(MR) Pitfalls in Pediatric Image Interpretation Michael Ditchfield, MBBS, FRANZCR Congenital Heart MRI Stephan Darty, B.S., R.T., (N)(MR)
10:00	Break	10:00	Break
	Moderator: Randy Earnest, B.S., R.T., (R)(MR)		Moderator: Ashok Saraswat, M.S., Bed. R.T., (R)(MR)
10:20	MRI Safety and Patient Management – Update 2009 Frank Shellock, Ph.D., FACC, FACSM	10:20	Neuro MRI Forum Advances in Epilepsy Imaging Robert J. Witte, M.D. Principles and Practices of Functional MRI Barry Southers, BRST, R.T., (R)(MR) (Some of) What You Always Wanted to Know About DTI - But Were Afraid to Ask Derek K. Jones, Ph.D.
11:20	SMRT Business Meeting	11:20	SMRT Business Meeting
12:00	SMRT Luncheon	12:20	SMRT Luncheon
	Moderator: Maryann Blaine, MAT, B.S., R.T., (R)(MR)		Moderator: Joseph Castillo, B.Sc., M.Sc.
12:45	Proffered Papers/President's Award Paper	13:00	Proffered Papers
13:45	Optimizing Your 3T Imaging William Faulkner, B.S., R.T., (R)(MR)(CT)	13:30	Clinical Musculoskeletal Imaging Forum MRI of the Ankle and Hind Foot John Skinner, M.D. MRI of the Hand and Wrist Kimberly Amrami, M.D.
14:45	Break	14:30	SMRT Awards Presentation
	Moderator: Anna Kirilova, B.Sc., R.T., (R)(MR)	14:45	Break
	Body MRI Forum Body MRI: Pathology and Techniques Nancy Talbot, MAppSc, M.R.T., (R)(MR) MRI of the Prostate Masoom Haider, M.D. How to Interpret Hepatic MRI Jeffrey Weinreb, M.D.		Moderator: Anne Marie Sawyer, B.S., R.T., (R)(MR)
15:00	Announcements/Close	15:00	Emerging Technologies Forum Ultra Short TE Imaging Graeme M. Bydder, M.B., Ch.B. Updates in Molecular Imaging Michael Moseley, Ph.D. Hyperpolarized Helium Lung Imaging Cynthia C. Harper Little, R.T., (R)(MR)



Join us in Honolulu!



Chapter Chat



Ashok Saraswat, M.S., B.Ed., R.T., (R)(MR)
Chair, Local Chapter Committee

I find myself very fortunate to wake up every morning and looking forward to going to work!

In addition, I truly enjoy interacting with so many folks at the SMRT and the list serve. Here in the USA, during an election year we are getting tired of hearing our politicians, from both sides, who would deliver CHANGE at a rapid speed. Someone once said "Change Is Inevitable." I too would report some good and not so good change in our Local Chapter listings. Since my last report, we have added the BeNeLux local chapter with chapter officers from Brussels and Amsterdam. Congratulations to **Filip De**

Ridder and his team for their ongoing extra ordinary efforts. The BeNeLux chapter offers quality educational seminars which are well attended. A new local chapter in New York, New York, USA is under the approval process. Thanks to **Cindy Comeau** and **Hina Jaggi** for taking the lead on starting this new chapter in the New York/New Jersey area. Discussions are under way in the Michigan and Kentucky regions for establishing new chapters as well. It would be advantageous to have local chapters, in most geographical areas worldwide.

It is exciting to report some of the upcoming quality educational seminars by the Atlanta, South Carolina, BeNeLux Belgium, Australia-New Zealand and Rocky Mountain local

chapters. These planned events will not be possible without the chapter leaders and their team. Read below about the recent local chapter meeting in Northeast Ohio.

With the above good news I will also share some not so good news. We have discontinued a few inactive local chapters with much hesitation. We are optimistic to reactivate these chapters as soon we find right people who want to help. Perhaps YOU are the right person to bring quality MR education back to YOUR local area.

If you would like to start a new local chapter or restore an inactive chapter, please contact **Ashok Saraswat**, e-mail ashok.saraswat@osumc.edu, any local chapter committee member or the SMRT office.

SMRT Regional Seminars Update



Janice Fairhurst, B.S., R.T., (R)(MR),
Chair, Regional Seminars Committee

2008 has proven to be a very busy year for SMRT regionals!

We are very happy to have

had several first time hosts who, with help from the central office, made organizing a Regional Seminar look easy! We hope

that the new comers will enjoy being part of the yearly "regulars" by continuing to build on the commitment and dedication of SMRT educational seminars. Let's make it our common goal to see SMRT regional meetings in every state in the USA and internationally in as many countries as possible. My sincere thanks to all of you who continue to help bring outstanding, quality

MRI education to a regional level! Recent Seminars:

And if you don't see a SMRT Regional planned in your area please contact me at jfairhurst@partners.org so that I can help plan one with YOU!



Northeast Ohio Local Chapter Meeting

Kris Barnhart, R.T. (R)(MR)(M)(CT)

The Northeast Ohio chapter recently held their 4th annual meeting. Over 40 MR technologists

attended this meeting featuring **Candi Roth** and **Charles Stanley**. We learned ways to manage stress in the workplace, how to communicate more effectively, and explored many MRI safety topics. The technologists enjoyed chair massages, as well as many

door prizes, including a Football Hall of Fame package. We are grateful to the SMRT as well as our corporate sponsors for their continued support of our chapter.

Northeast Ohio Local Chapter 4th Annual Meeting



Registration is a busy area prior to the Chapter meeting.



Left to Right: Jackie Turk, (CE Coordinator), Kris Barnhart, (NEO SMRT President), Darby Dummermuth (Treasurer), Pam Vincent,(SMRT President Elect), Shelly Betchel, (Secretary), Kathy Hampton, (Marketing Coordinator), and Kristy Calderwood, (Vice President)



NEOSMRT Attendees find their seats for the Northeast Ohio Chapter meeting.

2nd Annual SMRT John Koveleski Memorial Regional Seminar

Robin Kline, R.T., (R)(MR)
Co-Chair

The enthusiasm for MR education exemplified by the late John Koveleski is continued by dedicated SMRT leaders and members, who participated in the second annual seminar 9 August, 2008, Hershey, Pennsylvania. We thank the participants and sponsors of this special event.



Attendees gather for the Second Annual John Koveleski Memorial Seminar.



SMRT pioneer, Carolyn Roth, R.T. (R)(MR)(CT)(M)(CV) presented Protocol Optimization.



External Relations Committee Co-Chair, Charles Stanley, R.T. (R)(CT)(MR) shares information with attendees.



SMRT Past-President, Cindy Comeau B.S., R.T. (N)(MR) shares her proficiency in Cardiac MR Imaging.



Former SMRT Policy Board member James Stuppino relaxes between didactic sessions at the seminar.



Former SMRT Policy Board member and founding member of the Atlanta Local Chapter, Bobbi Burrow, R.T. (R)(CT)(MR) explained Abdominal Imaging at 3T.



Past SMRT Policy Board member and Chair of the External Relations Committee, Maureen Hood, M.S., R.N., R.T. (R)(MR) offered her expertise in Patient Care in the MRI Suite.

Northwest SMRT Regional Seminar

By Denise Echelard,
R.T., (R)(MR), Chair

On October 4th approximately 60 MRI technologists gathered in the windy city of Seattle. They gathered to reconnect and learn from 5 generous speakers who donated their time and efforts.

The morning started off with an enlightening talk by **William Bush, M.D.** professor and director of Geniurology Radiology at the University of Washington, who spoke on NSF and Contrast Reactions. Dr. Bush has literally written the book on contrast reaction response and laid out the steps to a common sense approach. It was a valuable review on the topic and left us feeling more confident in our skills of identifying and responding in dangerous situations. His presentation on NSF helped to answer many of the questions that audience had in regards to this new topic in MRI and helped the technologists to prepare and compare guidelines to take back to their sites.

Eric Rosen, M.D. of Seattle Radiologists was the second speaker of the day. His talk on imaging Ductal Carcinoma In Situ went a step beyond the usual how-to approach of breast imaging to show the audience what it is the study is looking for. The latest approach to cancer treatment is to find cancer at its earliest stages in order to more successfully treat patients for a better

outcome. Breast MRI plays an important role in this area and with research that Dr. Rosen is participating in we can expect to play a part in increasing patient's odds of survival.

Our third speaker of the day was no stranger to the audience. **Jeff Maki, M.D.** is the director of Body Imaging at the University of Washington and has presented his infamous MRA talks at the last several meetings in the Seattle area. He changed his topic this time and discussed the "Nuts and Bolts of Cardiac Imaging." Cardiac imaging has gone from a concept to reality in MRI and Dr. Maki's talk helped to answer many of the attendee's questions. His accessible style of presenting complex information has helped many of us over the years to grasp difficult concepts and leave with a more confident base of knowledge.

A blustery day left the attendees to enjoy lunch taking advantage of the views of the waterfall in the atrium and sun room in the café next door while catching up and networking.

The afternoon started off with **Mike Richardson, M.D.**, Director of Musculoskeletal Imaging at the University of Washington and the most effective antidote to post lunch snoozing we've seen yet. His

humorous presentation on MSK Imaging kept the audience in stitches, all the while imparting the radiologist's perspective of what they are looking for in imaging excellence.

John Posh, R.T., (R)(MR), Vice President of Animal Scan, rounded out our day. His presentation on scanning mummies provided a fascinating and irreverent look in into the world of forensic imaging. It was all the more appropriate here in Seattle as he has imaged mummies in our own fair city. John did double duty and covered one of the most important aspects of our daily grind, MRI Safety. As we all well know you can never be too vigilant and the renewed reminder is always welcome.

On a personal note I would like to express my appreciation to the SMRT for the opportunity to have been involved in these meetings over the years. I've learned a great deal and had the opportunity to connect and reconnect with so many people over the years. The SMRT, and Jennifer Olson in particular, provide a supportive and positive approach to education and professionalism in our field. My thanks to all of the attendees and sponsors, without whom there wouldn't be these opportunities, for their patience and loyalty over the years.



John Posh, R.T., (R)(MR) shares his experience on MRI Safety



The quality speakers held the attention of the attendees.



Attendees share a light moment during the seminar



SMRT Educational Seminars Home Study Update

Anne Marie Sawyer,
B.S., R.T., (R)(MR)
Editor
SMRT Educational
Seminars
Home Study Program

We are pleased to present the SMRT Educational Seminars, Volume 11, Number 4: "MRI of the Abdomen." This is the forty-second home study developed by the SMRT, exclusively for the SMRT members.

In selecting articles for this home study as well as others including our new electronic home studies, I am constantly asking myself (and others, driving them to distraction) "What do technologists and radiographers need to know?" Possibly of greater importance, "What do technologists and radiographers want to know?" I am sure there are many things that we need to know but without the desire to learn, it is practically impossible to absorb the information and to retain it for later utilization. With that in mind, I am once again requesting all SMRT members to send me an email and tell me what topics you would like to see in these home studies, paper and/or electronic (amsawyer@stanford.edu).

I recently attended an ISMRM educational course on Practical Body MRI: Impact of New Technology in Berkeley, California, USA. I was honored to act as a co-organizer of the meeting that included **Nancy Talbot, M.App.Sc., M.R.T.(MR)** (**R**) from Toronto, Ontario, Canada, and **Bill Faulkner, B.S., R.T.(R)(MR)** from Chattanooga, Tennessee, USA as faculty. I was impressed to see the number of clinical MR facilities embracing so many new technologies including Diffusion-Weighted Imaging and Double Contrast Enhanced Imaging in the abdomen both as a means to improve early detection and specificity.

Pancreatic cancer is reported to be the fourth (or fifth, dependent upon the publication) leading cause of death from

SMRT Educational Seminars Volume 11, Number 4

MRI of the Abdomen

cancer in the United States. Worldwide, pancreatic cancer ranks thirteenth in incidence but eighth as a cause of cancer death. As with all cancers, early detection is critical. The ability to characterize, to differentiate between malignant and benign or slow growing cancers, is becoming more important as therapies are being developed that target specific disease. Our first article presents a carefully organized and conducted study of MR imaging of pancreatic cancer.

Whole-body diffusion-weighted imaging is a quickly growing technique for MR of the abdomen. This provides an additional tool to assist in the characterization of

disease, assessment of response to therapy and tumor staging. The scans are quick as we have come to expect from diffusion-weighted imaging, and as seen in this second article, a free-breathing technique that is reported as being "without slice misregistration, fat contamination, significant distortion or nonuniformity."

Contrast media continues to be developed to address special needs in imaging. Applications continue to evolve after the contrast is approved for use and experience is shared through word-of-mouth and peer-reviewed publications. Our third article reports on atypical findings in the use of delayed T1-weighted imaging using contrast enhancement to look at multinodular focal fatty infiltration of the liver. Our fourth article evaluates contrast-enhanced MRI of primary leiomyoma of the liver.

Our fifth and final article evaluates "Inversion-Recovery Fat-Suppression Techniques for T2-weighted Abdominal MR Imaging." A spectral-attenuated inversion recovery (SPAIR) fat-suppression technique is compared to conventional inversion recovery fat-suppression in clinical



Faculty from the ISMRM meeting Practical Body MRI: Impact of New Technology: Donald Mitchell, M.D., Thomas Jefferson University Hospital, Philadelphia, Pennsylvania USA; Nancy Talbot, M.App.Sc., M.R.T.(MR)(R), Princess Margaret Hospital, Toronto, Ontario CANADA; William Faulkner, B.S., R.T.(R)(MR), Wm. Faulkner & Associates, LLC, Chattanooga, Tennessee USA; and Caroline Reinhold, M.D., McGill University Health Center, Montreal, Quebec CANADA.

abdominal MRI.

We would like to express our grateful appreciation to **Chesanie Beam** (Lincolnton, North Carolina, USA) and Gina Greenwood (Madison, Wisconsin, USA) for writing the questions that compose the quiz required to obtain Category A continuing education credits.

Special thanks goes to **Lewis Shin, M.D.**, Assistant Professor, Department of Radiology, Stanford University, Stanford, California, USA for acting as our expert reviewer.

Thanks also to **Paul McElvogue**, SMRT Publications Chair and in the Berkeley, California, USA office of the ISMRM/SMRT, Jennifer Olson, Associate Executive Director, Mary Keydash, Publications Director, and

the staff for their insight and long hours supporting these educational symposia.

Finally, we would like to thank **John Wilkie** and all of the terrific people at Invivo Corporation who support our home studies program, the SMRT Educational Seminars. Their continuing support to advance technologist and radiographer knowledge brings quality continuing education to the SMRT membership worldwide.

Section for Magnetic Resonance Technologists

NEW Member Benefit: Electronic Home Studies



Electronic Versions of New Home Studies

The SMRT introduces a new way for its members to earn Category A CE Credits fast! Earn your **Category A Continuing Education Credits** on-line at <http://www.ismrm/smrt/ehs>.

The SMRT now has electronic versions of their *Educational Seminars* home studies available at the SMRT website. These electronic home studies will be available ONLY on-line and ONLY to SMRT members. At the SMRT website you can read the articles and take the quiz on-line!

These electronic home studies are being made available in addition to the quarterly issues that are mailed to SMRT members.

The "Safety of Magnetic Resonance Imaging in Patients with Cardiovascular Devices" is the first SMRT electronic home study available on-line. Simply read the article, answer the short quiz and earn **1.0 (one) Category A CE credit**.

Home Study Quiz On-line for Future Hardcopy Issues

All future SMRT *Educational Seminars* Home Studies will now have the quiz and answer form on-line at <http://www.ismrm/smrt/ehs>. Pending reprint permissions, we plan to post the actual article(s) from the home study on-line as well. The quiz and answer form are now on-line for the SMRT *Educational Seminars* Home Studies, Volume 11, Numbers 1 through 4. Read the home study, take the quiz, and earn Category A CE credits – Simple!! Your certificate of completion will be e-mailed to you.

Paul McElvogue, R.T., (R)(MR)
SMRT Publications Chair
paulmri19@aol.com



Anne Marie Sawyer, B.S., R.T., (R)(MR)
Educational Seminars Editor
amsawyer@stanford.edu



Magnetic Resonance Imaging Techniques of Non-Sedated Infants on a 3 Tesla Scanner at the New York State Psychiatric Institute

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

Satie C. Shova,
B.S.,R.T.(R)(MR)(CT)

Introduction:

This is a research study that involves conducting MR Imaging on babies who were born to mothers' that used certain drugs; such as cocaine, methadone and marijuana. These drugs may affect brain development when the infants are exposed while in the womb.

Equipment:

3 Tesla GE Signa HDX Imager (GE Medical Systems, Milwaukee, WI) along with the GE 8 channel receive head coil. Invivo Monitoring system (Orlando FL) is used during scanning. An Isolette (non-specific manufacturer) is used to keep the baby warm prior to imaging. An MR safe camera allows for visualization of the infant during the scanning. A Garret hand held and walk through metal detector (Garret Metal Detector, Garland TX) is used to ensure a safe ferrous free environment in the Magnet room.

Recruitment:

The mothers were recruited from various prenatal clinics and the New York-Presbyterian Hospital obstetrical floor, post delivery. After the delivery their infants were enrolled in the study. An Institutional Review Board (IRB) approved informed consent form was provided to the parents' of the infant, during recruitment and for follow-up. The consent form outlined the benefits and risks of the study. Once approval was received from the parent the research assistant scheduled an appointment for the MRI.

Scheduling:

A four and a half hour time slot is the minimum allowed for imaging. Babies typically wake up during the scan and have to be fed, burped and rocked back to sleep.

Safety:

All of our patients are scanned with a hand held and walk through metal detector, to ensure a safe environment in the magnet room. In addition, anyone who frequently enters the magnet room must view our safety videotape and is required to fill out a safety sheet and questionnaire after viewing the videotape. A metal safety screening sheet is used to give us a brief history of the infant.

The infant's safety is our foremost priority during imaging. A pediatrician is always present during the study to make sure the infant is able to undergo the scan and to monitor the heart rate and O₂ saturation during the scan. The infant is prepared for the study using prep gel to clean the area of the chest where the EKG leads are placed. Their ears are covered with the following ear plugs: foam, silicone and a mini muff that encapsulates the entire ear. All of our infants are swaddled using infant blankets, their arms are placed at their side and the blanket is wrapped to encompass the arms; an infant hat is used to keep the baby warm.

Set-up Procedure

The lights are turned off in the entire area and the magnet room. The baby is brought into the magnet room and is gently rocked to sleep either in the mother's arms or the arms of the research assistant who is involved in the set-up procedure. While the baby is being rocked to sleep our pediatrician is

monitoring the heart rate and O₂ saturation. Once the baby is asleep he/she is placed on our MRI table.

An eight channel receive only head coil is used for imaging. The baby's head is placed within the cradle and additional soft foam is placed around the ears for extra hearing protection. In order to acclimate the baby to the different sounds of the sequences which are used, a recording was made of these sequences and is played while the baby is inside the magnet. When the baby is sound asleep the scan begins.

Sequences

- 1) A localizer which allows us to set up the scans. (Noise of the sequence is played prior to scan)
- 2) Calibration Scan for Parallel Imaging (Asset)
- 3) Propeller T2 weighting scan
- 4) Spectroscopy
- 5) Diffusion Tensor Weighted (DTI)
- 6) Fmri (Functional MRI) and HRV
- 7) T1 and T2 Relaxometry
- 8) T1 Weighted scans.

Sequence Rationale

3 plane localizer is used for setting up other scans

Calibration Scan for Parallel Imaging:

Parallel imaging is a technique of data acquisition and image reconstruction, which uses phased array RF (radio frequency) coils to reduce scan times in data acquisition for MRI and uses the spatial information

of the sensitivities of the coil components to reconstruct MR images. The spatial information of sensitivities of the coils is obtained by the calibration scan and is used for all the following scans that use the parallel imaging scheme.

Propeller scans are used because the method has been proven to be successful in imaging non sedated patients. (PROPELLER MRI: clinical testing of a novel technique for quantification and compensation of head motion. Kirsten P FORBEST1, James G PIPE1, Roger BIRD1, Joseph E HEISERMAN11Barrow Neurological Institute, Neuroradiology, St Josephs Hospital and Medical Center, Phoenix, AZ USA;)

Spectroscopy

We utilize a pulse sequence for MultiPlanar Chemical Shift Imaging (MPCSI), which was designed by JH Duyn et al at the National Institute of Health (NIH) and was provided by JW van der Veen (National Institutes of Health, Bldg 10 B1D64, Bethesda, MD 20892). This is a fast acquisition sequence that can acquire MRSI data from multiple sections of the brain in a relatively short time. The parameters we used are as follows. FOV = 16 cm x16 cm; Number of slices = 4; Slice thickness and spacing = 10/2 mm; TR/TE = 2300/144 ms; Number of phase encodings = 16 x16. The nominal spatial resolution is therefore 1 cm³. The total scan time, including imaging volume prescription, scout image scan and shimming, is about 20 minutes.

Diffusion Tensor Imaging (DTI)

DTI allows us to visualize the location, the orientation, and the anisotropy of the brain's white matter tracts. We use the following parameters for our DTI Sequence, Epi ,Diff, asset ,TE=Min, TR=1325, Shots=1, Fov=19.0,Sl thickness=2.0, Spacing=0, 50-60 slices , Freq 132 Phase 128,Nex=1, Full phase Fov, Dir R/L, Phase direction =yes and Fat Sat.

fMRI and HRV

We acquire functional Magnetic Resonance Imaging (fMRI) data from each infant without the performance of a cognitive task while he/she is asleep, to study the development of default mode neural networks of the infant brains. The fMRI data will be analyzed in an exploratory way by using independent component analysis (ICA) combined with a novel algorithm for the automated identification of independent components, Partner Matching (PM), which has been developed in our lab. We use the following parameters to acquire the fMRI data from infants: EPI axial sequence, with TR=2200ms, TE=30ms, matrix of 64x64, FOVx = FOVy=19cm, slice thickness =5mm, slice spacing =0, flip angle =900, 6 scanning runs for each experiment, 102 volumes for each run.

During the entire MRI scanning procedure, we also record an electrocardiogram (ECG) from each infant. The ECG recordings will be converted into heart rate variability (HRV) signal and stored for further spectral analysis. It has been verified that the lower frequency band (0 to 0.15Hz) and higher frequency band (0.15 to 0.5Hz) in the spectrum of the HRV signal reflect the sympathetic and parasympathetic activities, respectively. We will use the spectral features of the HRV data to assess the development of the autonomic function.

T1 and T2 Relaxometry:

Relaxation times are relevant in comprehending the physical properties of water within the biological systems. These sequences offer an explanation of the comprehension of pathological processes within the brain. These properties include the water content of gray matter and white matter, which change throughout fetal and postnatal life. Relaxometry has the added value for longitudinal studies because its parameters can be held constant with repeated imaging over gestation, unlike T1-to compensate for age-related changes in

relaxation times. Relaxometry therefore was adapted to document changes in tissues of the fetal brain during development.

Our relaxometry protocol uses fast spin-echo (FSE) sequences with high echo train lengths (ETL) to acquire T1 and T2 relaxation times in the fetal brain. Non-spin-echo sequences are prone to susceptibility-induced distortion artifacts, which increase greatly during in utero imaging, particularly at high field strengths. FSE and T2-weighted images will require reoptimization at each point in development.

We use the following parameters FSE-IR 60,SEQ IR,Oblique,2DMode,IMG opt=seq,vbw,fast,asset the TR on this sequence will remain constant but the TE will vary.

TE selections are the following min full.3500TR,32 etl,15.63bw,19 FOV,3mm thick 0mm space,256,128phase 1 nex,.80phase FOV. TE changes are: minimum full, 35, 70, 105, 140, 175, 210, 234. Our T1 parameters are min full TE,10000TR, 60 IR time,34etl,15.63 bw,19 FOV, 3mm thick, 0 mm spacing ,256freq and 128 phases. The IR times are 60, 300, 750,1500, and 3000.

T1 Weighted Scans; use short TR and TE to show contrast between tissues with different T1 values; an image with greater signal intensity from fat-containing tissues.

The parameters are identical to that of the T2 Propeller.

Conclusion:

Our research project is still underway with promising results.



Preventing Infection in MRI -Best Practices: Infection Control in and around MRI Suites-

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

Peter Rothschild, M.D.
President and Founder:
Patient Comfort Systems Inc.
Medical Director:
High Field and Open MRI Patient Comfort Systems Inc. Hayward, California
High Field and Open MRI Louisville, Kentucky

Healthcare- and community- associated infections are a major and growing problem in the United States as well as throughout the world.

Healthcare associated infections (HAI's) constitute a major public health problem in the United States affecting 5 to 10 percent of hospitalized patients annually, resulting in approximately 2 million cases of HAI's , 90,000 deaths and adding \$4.5 to \$5.7 billion in healthcare costs ^{1,2}.

Most patients with serious infections typically have some type of imaging procedure performed during the course of their treatment. Radiology departments and outpatient imaging centers must take appropriate action to assure patients that their MRI scanner is not a significant hub for microorganisms capable of causing infectious diseases. However, for a multitude

of reasons, MRI suites often lack the most basic of safeguards against infection, where, due to its unique environment, it is extremely difficult to implement and maintain an effective infection control policy. Because of the dangers from extremely strong magnetic fields³, as demonstrated by a well-publicized patient death from an accident in an MRI^{4,5}, housekeeping staff and most cleaning equipment are usually prohibited from entering the MRI suite. The resultant lack of thorough cleaning was clearly demonstrated in a recent study from Ireland that cultured MRSA from within the bore of the MRI system⁶.

When one goes to a restaurant there is an assumption of cleanliness and the knowledge that there is an organization (the county health department) that comes in and inspects to assure food safety and cleanliness. However, even though the public assumes the proper infection control procedures are in place, there is no one organization that evaluates these MRI suites for infection control. The author has often found, especially in free standing outpatient centers and mobile MRIs, a complete lack of

even the basic infection control procedures, such as hand washing or cleaning the room between patients.

The pictures below are just a few examples of just how unbelievably dirty these MRI suites can be.

Methicillin Resistant Staphylococcus Aureus (MRSA)

MRSA was originally identified in 1961 and is now widespread throughout healthcare facilities, both hospital and outpatient settings⁷. The most common source for transmission of MRSA is by direct or indirect contact with people who have MRSA infections or are asymptomatic carriers.

In 1972 MRSA accounted for only 2% of all *Staphylococcus aureus* infections, but now it is responsible for 50 to 70% of these infections⁸. MRSA is among those microorganisms commonly referred to as a "super bug". MRSA may be community associated, CA-MRSA, or healthcare associated HA-MRSA⁹.

The morbidity and mortality of these bacteria is staggering. On average, hospitalizations for the treatment of MRSA



Cables in the MRI Room



MRI Floor - Note that only the front half has been cleaned



MRI-Compatible Aluminum IV Pole

Continued on page 17 ➞

versus other infections have a length of stay approximately 3 times longer and are 3 times more expensive^{10,11}. Additionally the risk of death is 3 to 5 times greater for patients infected with MRSA versus methicillin sensitive *Staphylococcus aureus*^{11,12}.

A major concern for imaging centers is that MRSA can be carried by asymptomatic persons. Worldwide, it is estimated that up to 53 million people are asymptomatic carriers of MRSA^{13,14}; of these it is estimated that 2.5 million reside in the United States. Approximately 1% of the US population is colonized with MRSA¹⁵. Both infected and colonized patients contaminate their environment with the same relative frequency¹⁶. Therefore, any patient lying on an imaging table could be a carrier capable of contaminating surfaces in the radiology suite. MRSA and other pathogens can live on inanimate surfaces including common table pads and positioners for periods as long as several months^{17,18,19,20,21}.

Center for Disease Control (CDC)

The Center for Disease Control and Prevention (CDC) has developed guidelines for environmental infection control in healthcare facilities. The CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC) issued a 249 page document extensively detailing their recommendations concerning, in part, the principles of cleaning and disinfecting various surfaces, including surfaces frequently found in radiology suites such as bed linens, pillows, mattresses, carpeting and cloth furnishing²².

The CDC cited numerous well-controlled studies indicating that MRSA can be spread by contaminated surfaces.

In section G, Laundry and Bedding, #8, the authors state: "Standard mattresses and pillows can become contaminated with body substances during patient care if the integrity of the covers of the items is compromised... A linen sheet placed over the mattress is not considered a mattress cover. Patches for tears

or holes in mattress covers do not provide an impermeable surface over the mattress...Wet mattress in particular can be a substantial environmental source of microorganisms. Infections and colonization by MRSA have been described."

In Section G, #2, Epidemiology and General Aspects of Infection Control the authors provide detailed information about contaminated textiles and fabrics, stating:

*"Contaminated textiles and fabrics often contain high numbers of microorganisms from body substances, including blood, skin, stool, urine, vomitus, and other body tissues and fluids. When textiles are heavily contaminated with potentially infective body substances, they can contain bacterial loads of 106–108 CFU/100 cm² of fabric. Disease transmission attributed to health-care laundry has involved contaminated fabrics that were handled inappropriately (i.e., the shaking of soiled linen). Bacteria (*Salmonella* spp., *Bacillus cereus*), viruses (*hepatitis B virus [HBV]*), fungi (*Microsporum canis*), and ectoparasites (scabies) presumably have been transmitted from contaminated textiles and fabrics to workers via a) direct contact or b) aerosols of contaminated lint generated from sorting and handling contaminated textiles."*

The American College of Radiology Safe MRI Practices 2007²³

The American College of Radiology (ACR) has developed a document for safe MR Practices, most recently revised in 2007.²³ The ACR has divided up the MRI area into four zones. The most critical zone is Zone IV which is the magnet room itself. To enter this zone without supervision, the person must be Level 2 trained.

Level 2 trained are "those who have been extensively trained and educated in broad aspects of MRI safety issues including issues related to potential for thermal loading or burns and direct neuromuscular excitation from rapidly changing gradients. This is in addition to successfully completing at least one of the MRI safety lectures or

pre-recorded presentations approved by the MR medical director. Then it should be repeated at least annually and appropriate documentation should be provided to confirm these ongoing educational efforts." It goes on to say that it the responsibility of the MR medical director not only to identify the necessary training but also identify those individuals who qualify as Level 2 MR personnel. The ACR also specifically requires that any non-Level 2 personnel entering the scan room must be accompanied by, or under the immediate supervision of and in visual or verbal contact with a specifically identified Level 2 MR personnel for the entirety of the duration within the scan room. Additionally, these non-Level 2 personnel, i.e. cleaners, must also go through a thorough screening to make sure that they do not have a pacemaker, aneurysm clip or any other dangerous ferromagnetic objects in or on their body. This is why cleaning crews are normally not allowed to go into the scan room.

The number of accidents within MRI suites appears to be a growing problem. Between mid 2005 and mid 2006 the FDA received a 140% increase in reported MRI accidents²⁴. MRI safety has become such an important topic that the American College of Radiology has issued White Papers on MRI safety, most recently updated in 2007. The Joint Commission has recently released a Sentinel Event Alert titled "Preventing accidents and injuries in the MRI suite"²⁶. Each of these documents emphasize the importance of designating the various areas within the MRI area into Zones I – IV, depending upon the static magnetic field of each zone and the consequent safety precautions that must be taken in each zone. The most dangerous zones are the MRI control room, Zone III, and the MRI suite itself, Zone IV. Both Zone III and Zone IV are within "the region in which free access by unscreened non-MR personnel or ferromagnetic objects or equipment can result in serious injury or death". They

are considered dangerous enough that they "should be physically restricted from general public access by, for example, key locks, passkey locking systems, or any other reliable physically restricting method that can differentiate between MR personnel and non MR personnel." "Only MR personnel shall be provided free access, such as access keys or passkeys, to Zone III."²⁷ The major risks involve metallic objects being brought in by unauthorized and untrained personnel. The technologist who runs the MRI is the one responsible for this access control. Therefore, when the technologist is not present, all access should be denied to the MRI suite. This would include after hours cleaning crews. The ACR Guidance Document for Safe MR Practices: 2007 discusses restrictions on housekeeping and cleaning personnel from Zones III and IV.²⁸

The 17 text pages of the ACR Document for Safe MRI Practices 2007 contain only one paragraph of information on Infection Control:

"12. Infection Control (Zone IV)

Because of safety concerns regarding incidental personnel within the MR suite, restricting housekeeping and cleaning personnel from Zone III and/or Zone IV regions may give rise to concerns about the cleanliness of the MR suite. Magnet room finishes and construction details should be designed to facilitate cleaning by appropriately trained staff with non-motorized equipment. Additionally, as the numbers of MR-guided procedures and interventional applications grow, basic infection control protocols, such as seamless floorings, scrubbable surfaces, and hand-washing stations, should be considered."²⁹

This paragraph confirms the widespread practice of restricting cleaning crews from entering the MRI suite. This author knows of no imaging center or hospital that pays their Level 2 MR personnel (i.e., the technologists) to wait around for the cleaning crews to come in and monitor them the entire time

that they are cleaning the room. Therefore, the responsibility to clean the scan room is sometimes assigned to one of the MRI technologist or, more commonly, this responsibility is simply overlooked. However, the paradox is that the MRI technologist, who in almost all imaging centers is the Level 2 trained person, is rarely an experienced or even trained cleaning person with very limited time to clean.

This paradox is clear when asking the question, "Is the scan room being cleaned and if so by whom?" The answer that this author normally receives is "of course it's being cleaned by the cleaning crews that come in at night after we leave." It is crucial to ask the next question, "What Level 2 personnel are present to monitor the cleaning crew to make sure that it is done properly and safely?" This author knows of no cleaning crew that has the background training to be Level 2 personnel. Additionally, the cleaning crews contacted by this author have all stated that they been told or simply assume that they are not to go into the scan room. Cleaners often describe the MRI suite as the room with all the signs on the door warning them not to enter.

The MRI Suite

The area of greatest challenge for preventing the transmission of MRSA and other infections in Radiology is clearly the MRI suite. Due to the high magnetic field, posing a danger to both the personnel and to damaging the MRI itself, and to comply with the American College of Radiology recommendations²³ it is the author's experience, that many free standing imaging centers and hospitals do not allow cleaning crews to enter the MRI suite. Therefore these MRI suites are rarely, if ever properly cleaned.

This is a risk to staff and patients because MRSA can be transmitted by contact with contaminated surfaces such as mattress pads^{30,31}. It has been proven that MRSA

can survive on surfaces such as tabletops and charts for up to 11-12 days³². Similarly, Vancomycin-resistant enterococci (VRE) had a 50% survival at seven days on upholstery, furniture and wall coverings and could easily be transferred by touching contaminated surfaces³³. There is an increased risk of VRE/MRSA for patients in the presence of environmental contamination, 5.1% increased risk for MRSA and 6.8% for VRE^{34,35}. There is an increased risk of an MRSA acquired infection for patients admitted to a room that was previously occupied by a patient colonized with MRSA³⁶.

At many MRI centers, there exists a false belief that merely placing a clean sheet over the table pads, without actually cleaning them between patients, will prevent the spread of infectious agents. What is most concerning is that very few MRI centers clean their pads even once a day, much less between patients. Cleaning pads during working hours typically has a very low priority, because it is time consuming, decreases throughput and thereby decreases the center's productivity and negatively impacts the financial well being of the center.

Additionally, MRI technologists, especially those who trained in the 1970's and 1980's, had little training in infection control or proper cleaning procedures. An average MRI may scan 3,000 to 5,000 patients a year. CT scanners usually scan double or triple that number. The probability is that at least 50 – 100 of these patients are infected with MRSA or other HAI^{37,38}, and many more are carriers.

Another area of potential exposure to infectious agents is the use of IV contrast material for both CT and MRI, which significantly increases the risk of blood contamination. The simple task of removing a needle from a patient's arm and placing it into the sharps container has great risk. Blood can drip from the needle or from the

puncture wound onto the pads, table and floor. This blood can often be unnoticed by a busy technologist or doctor performing the injection resulting in a contamination risk. It is not uncommon to find dried blood in an imaging suite which is an excellent culture medium for MRSA.

There is also concern for spreading infectious bacteria by direct or indirect contact among the imaging staff and patients within the imaging department or center. MRSA infections can be acquired by staff members through a simple cut or other break in the skin that may not be noticed during a busy day. Therefore, hand-washing between patients as well as hand sanitizer use for the entire staff is of crucial importance^{39, 40, 41}. Regarding mobile MRI, ensuring proper hygiene is even more difficult since they do not have a sink or running water.

Bacteria and Table Pads

One much overlooked concern is the torn and frayed pads used in imaging departments and centers. Once the covering material has been breached, pads cannot be properly cleaned and should be immediately removed and replaced. This is clearly demonstrated by Oie in his article "Contamination of Environmental Surfaces by Staphylococcus aureus in a Dermatological Ward and Its Preventive Measures". In the article the author states, "... items with a smooth surface can be repeatedly used without problems if disinfected. However, on items with a porous surface made of a spongy material, S. aureus was detected even after disinfection had been done. Thus, porous surfaces made of such material cannot be adequately disinfected"⁴².

In the late 1980's and early 1990's when many of the pads systems in use today were developed, they were not designed to take the wear-and-tear of five to ten thousand patients a year for so many years. The fabric covers were coated with some type of

plastic to make it water proof. However this plastic wears off especially with cleaning solutions as well as with use. As a result, pad coverings have worn out exposing the foam core or have lost their ability to prevent penetration of bacteria and fluids into the central core, where it is not possible to be cleaned.



Torn and Frayed Table Pad

Only in the last 5 to 10 years have hospital-acquired infections become so significant. Before that time there was very little concern for contamination and MRSA was not as prevalent as today. Therefore, pads on most imaging tables do not incorporate newer technologies developed to assist in infection control. Permanent antimicrobial agents should be incorporated into all table pads and positioners and scanner controls, keyboards, etc. For added protection, the seams of the table pads should not only be tightly sewn, but also welded closed or have another permanent barrier in place in addition to simple stitching. The integrity of these seams is crucial in protecting patients.

Another area of concern is that of aerosolization of MRSA bacteria. Table pads inherently have air within them. When a patient lies down on the pads, this air is forced out through any hole or seam in the covering materials. This can cause the bacteria contaminating the central foam core to become ejected from the pad and aerosolize into the room environment. Of course the reverse air flow caused by the patient arising off the pads causes infectious materials to be drawn into the foam core from the surface, which is then re-ejected into the air when the next patient lies on the

pad. There have been numerous articles discussing the possibility of MRSA or other pathologic microorganisms becoming airborne during activities such as bed making⁴³ and thus the possibility that MRSA can be transmitted among patients through the air (Shiomori)⁴⁴. There is also a suggestion that airborne MRSA may play a role in MRSA colonization of the nasal cavity or respiratory tract⁴⁵. Wilson showed that the presence of airborne MRSA in an area is strongly related to the presence and number of MRSA colonies and infected patients in that area⁴⁶. Shiomori states that measures should be taken to prevent the spread of airborne MRSA to control nosocomial MRSA infection⁴⁷.

This is clearly another reason why all pads must be inspected with a magnifying glass, and if any holes or loss of integrity of the covering material in any way is detected, the pads *must be replaced*.

Black (ultraviolet) Light Detection of Body Fluid Contamination that may Indicate Fraying

It is also important that all pads be periodically tested using a black light to detect biologic contamination. A black light provides light in the ultraviolet wavelengths that is especially sensitive in detecting biological material such as blood, fingerprints, body fluids, etc. Biological material remaining on the pads will light up under black light exposure. This is an excellent way to confirm that the cleaning procedures are adequate. If biological material remains after proper cleaning it may indicate the covering material has been frayed or breached, thus allowing fluids to seep into the fabric itself and possibly penetrate to the underlying foam. Experiments performed by Ryan Whitney (a medical student who experimented with MRSA and MRI pads) (personal communication) have shown that MRSA could even go through frayed fabric covers without a tear and get into the central core

where it is not possible to disinfect. This also demonstrates the necessity for pads and positioners to contain permanent antimicrobial agents in the covers and foam cores. More studies are needed to more thoroughly understand the depth of this problem and exactly how many pads in use today are contaminated.

A product called **Glo Germ™ Kit** which contains plastic "simulated germs" can be used for hand washing training. **Glo Germ™ Liquid** is rubbed onto one's hands like lotion. For surface cleaning, **Glo Germ™ Powder** is dusted onto surfaces and generally throughout the entire area. Next wash your hands or clean the area as normal. Under normal light, hands and the surfaces will appear clean. However, ultraviolet light will show any "Glo Germs" remaining. This is an excellent way to train personnel in proper hand washing and pad cleaning procedures.

The Magnet Bore

An area of proven risk of MRSA⁶ is the inside of the MRI itself, often referred as the magnet bore or tunnel. The risk of MRSA transmission is increased in this area because the patient is often touching or in very close contact with the surface of the bore. It is obvious that cleaning inside the bore of an MRI unit is a difficult, dangerous and cumbersome task. The fact that most cleaning tools can not even be brought inside the MRI room, and especially into the bore, makes this task even more difficult. The best possible way to clean the bore is to physically crawl inside to clean and disinfect the entire bore by hand. Unfortunately this also puts the technologist in very close contact with the contaminated surfaces and is yet another reason this is almost never done. In fact, the author, in over 25 years, has never seen a cleaning crew or technologist clean the inside of the MRI bore.

One alternative for cleaning, sanitizing and disinfecting inside the MRI bore and its

surroundings, is to use a cleaning tool long enough to reach well inside the bore that has some kind of pad or sponge at its end soaked with a disinfectant.

MagnaWand Inc. has invented such a cleaning tool that is completely non-magnetic, and designed exclusively to clean and disinfect the MRI bore and its surroundings. With the MagnaWand tool, technologists can easily reach inside the bore and clean, using the disinfectant, directly onto the surface. Once the area of interest has been cleaned and disinfected the disposable pad is simply ejected from the tool without being touched by the technologist's hands, eliminating the risk of further contamination.

Personal Experience

The issue of infection control became very personal when my wife, who is also a physician, suffered an injury last year and was at a well-known medical center. Like many patients she needed an MRI before she could be discharged.

When my wife arrived for her MRI, they were running late. This is very common situation, which puts tremendous pressure on the Technologist operating the MRI to keep up and get back on time.

The patient before her was clearly a patient from isolation ward and appeared to have been squeezed into the schedule. Everyone was wearing a mask and gloves. She over heard that the patient had a possible unknown virus infection and was felt to be contagious.

My wife insisted that the technologist thoroughly clean the pads and especially the head coil that was used on the previous sick patient and would be used on her. He said that there was absolutely no time for this and if she would not get on the table right away, that he would just go on and scan the next patient and she would be able to explain to her doctors and insurance company why she refused her MRI. My wife

desperately needed the MRI so she could be discharged from the hospital.

When she came back after completing MRI she was absolutely in tears. She knew that she made a mistake, but like many patients felt pressure to complete her study.

This is just one example of what happens daily in busy hospitals and imaging centers throughout the country. I have talked with numerous patients, many of which have MRSA and they express very similar experiences when they underwent their MRI's.

Technologists have also expressed frustration that they are pressured from management to scan as many patients as possible and keep on schedule no matter what. Technologists have been let go because they were "slow" and could not keep up with an unrealistic number patients to be scanned during their shift.

This is why there **must** be a written infectious disease policy not only to protect patients but also the technologist

How did it get so bad?

A question frequently asked is "how did the standard of practice for infection control become so overlooked in MRI suites?" There are several reasons. First, the dangers presented by the extremely strong magnetic field make it imperative that all personnel put magnetic safety first. Unfortunately, the focus has become solely on the dangers of the magnetic field, and infection control has taken a back seat.

Another factor is that the significant decrease in reimbursement for MRI has forced MRI centers to rush patients through in order to scan more patients per day. Relative to this latter issue, it is now a common practice to provide financial incentives for the MRI technologist to increase patient throughput, i.e., the number of patients scanned during a certain amount of time. That is, the technologist receives a

Suggestions For Infection Control Procedures For Free-Standing Imaging Centers and Hospital Radiology Departments

The cleanliness of free-standing imaging centers and hospital radiology departments is crucial for reducing the spread of MRSA and other acquired infections. The following are 11 simple procedures to implement that can prevent the spread of these infections.

1. Have a written infectious control policy to include MRI cleaning procedures as well as the cleaning schedule and have it posted throughout the center.
2. Implement a mandatory hand washing / hand sanitizing procedure between patient exams for technologists and any others who come into contact with patients.
3. Clean the MRI tables, inside the bore of the magnet and any other items that come into contact with a patient. Infection control experts recommend this be done between each patient.
4. Clean all pads and positioners with an approved disinfectant. Infection control

experts recommend cleaning after each patient.

5. Periodically inspect the pads with a magnifying glass, particularly at the seams, to identify fraying or tearing. If present, the pads should be replaced.
6. Regularly check all padding material with an ultraviolet (black) light and make sure that any biological material detected on the pads can be removed.
7. Replace damaged or contaminated pads with new pads incorporating permanent antimicrobial agents.
8. Use pillows with a waterproof covering that is designed to be surface wiped. Replace pillows when their barrier is compromised.
9. Promptly remove body fluids, and then surface disinfect all contaminated areas.
10. If a patient has an open wound or any

history of MRSA/other infection:

- a. Gloves and gowns should be worn by all staff coming in contact with the patient. These barriers must be removed before touching other areas not coming in contact with the patient, i.e. door knobs, scanner console, computer terminals, etc.
- b. The table and all the pads should be completely cleaned with disinfectant before the next patient is scanned, if it is not already being performed between every patient. For patients with any known infectious process add 10-15 minutes onto the scheduled scan time to assure there is enough time to thoroughly clean the room and all the pads.
11. All furniture should be periodically cleaned. Ideal surfaces are those that are waterproof and wipeable. Infection control experts recommend this be done between each patient.

bonus based upon scanning more patients in less time.

The other practice that contributes to this situation is that MRI center often will overbook, that is put patients in time slots that are too short to perform a complete study, or add patients on to a full schedule. This is similar to the airlines overbooking, knowing that a number of patients will not show up for their appointment. Unless an MRI center overbooks patients, the "no shows" will have a disastrous effect on the bottom line since they take up time slots which cannot be charged for. Merely two "no shows" a day, can mean up to \$300,000 loss from the bottom line each year for an MRI center that may already be struggling.

The profit of these imaging centers, which is a fixed cost business, is directly proportional

to the number of scans completed in a day. The difference between scanning two patients an hour and three patients an hour can be significant, accounting for as much as an additional \$1 – 2 million in annual revenue.

This is why the technologists and staff are being rewarded for improved efficiency and reducing the time between scans. Taking time to clean the table and pads or even wash their hands between patients interferes with the technologists' incentive to decrease the room turn around time and thereby increase the total number of scans completed. Even without cash incentives, technologists are under intense pressure to get the patients on and off the table and the room turned around as fast as possible. Technologists have been terminated because they were "too slow". The overbooking issue only adds to the problem.

To save money and time, many imaging centers have elected to allow patients to wear their street clothes during their MRI instead of having them change into clean gowns or scrubs. This significantly reduces patient turn-around time and associated costs, i.e. laundry and staff time to assist patients. However, this also allows any bacteria on the patient's clothes to cross contaminate the next patient scanned in the magnet.

An important area that patients and their doctors are often not aware, is that since MRIs does not use any ionizing radiation, these centers are not required to adhere to state regulations concerning x-ray. This means that the person who operates the MRI does **not** need to be a registered radiologic technologist (RT) as with an X-ray device. Basically, anyone can scan a patient on an MRI, without any formal training, much less

Continued on page 22 ➤

an understanding of infection control. This is seen most commonly in small imaging centers, MRIs in physician's offices and mobile MRIs. There have been situations where the truck driver who moves the mobile MRI, also scans the patients, as well as front desk personnel being crossed trained to operate the MRI. There are tremendous cost benefits to using a less qualified individual than a highly trained and highly paid registered radiologic technologist. Unfortunately, one often has no way to know the qualification of the person scanning without specifically asking, which most patients are very uncomfortable in doing.

Conclusion

Patient safety should be the primary concern of any healthcare organization. Protecting patients and staff takes a concerted effort by all the parties involved in diagnostic imaging. There is no question that infection control has not received the attention it deserves. There is a growing concern that at least some of the spread of infectious agents could be coming from outpatient imaging centers and radiology departments in hospitals.

However, almost no attention has been paid to infection control inside these MRIs. This is demonstrated by the fact that there has been only one published research project ever to even explore the possibility of infectious disease inside an MRI and this study was performed in Ireland and presented in 2006. The study only tested one magnet, but found that there was MRSA present in the magnet. It is quite telling that there have been no follow up studies since that time.

Further research is now required to determine the percentage of MRIs in this country that harbor MRSA. It is crucial that we assure patients that proper infection control procedures are being performed in the MRI suite to ensure the future success of MRI. It is understandable that this would

be somewhat painful and expensive for MRI centers and hospitals, however in the long run, it will be crucial to address this issue before it becomes a national problem requiring government intervention and regulations. Imaging centers and hospitals owe it to their patients, to assure that their safety is the top concern during their MRI experience.

References

- ¹ Cosgrove SE, Qi Y, Kaye KS, Harbarth S, Karchmer AW, Carmeli Y. Infect Control Hosp Epidemiol. 2005 Feb;26(2):166-74. Comment in: Infect Control Hosp Epidemiol. 2006 Sep;27(9):994-5. The impact of methicillin resistance in *Staphylococcus aureus* bacteremia on patient outcomes: mortality, length of stay, and hospital charges
- ² Engemann JJ, Carmeli Y, Cosgrove SE, Clin Infect Dis. 2003 Mar 1;36(5):592-8. Epub 2003 Feb 7. Related Articles, Adverse clinical and economic outcomes attributable to methicillin resistance among patients with *Staphylococcus aureus* surgical site infection.
- ³ Chaljub G, Kramer LA, Johnson RF III, Singh H, Crow WN. Projectile cylinder accidents resulting from the presence of ferromagnetic nitrous oxide or oxygen tanks in the MR suite. AJR 2001; 177:27-30
- ⁴ Fatal MRI Accident is First of its Kind. Peggy Peck. WebMD News. August 1, 2001. <http://www.webmd.com/news/20010801/fatal-mri-accident-is-first-of-its-kind>
- ⁵ ECRI Hazard Report. Patient Death Illustrates importance of adhering to safety precautions in magnetic resonance environments. Health Devices 2001;30:311-314.
- ⁶ Scanlon T, Murray J. MRSA Detection in the Radiology Department, code LL-HS4369-L04, presented at the RSNA meeting 2006
- ⁷ Understanding MRSA. WebMD. <http://webmd.com/skin-problems-and-treatments/understanding-mrsa-methicillin-resistant-staphylococcus-aureus>. Accessed march 9, 2008
- ⁸ Soule, B. Avoiding the Drama of Hospital Acquired Infections. Hospitals and Health Networks. January 29,2008 http://www.hhnmag.com/hhnmag_app/jsp/articledisplay.jsp?dcpath=HHNMAG/Article/data/01JAN2008/080129HHN_Online_Soule&domain=HHNMAG
- ⁹ Healthcare-associated infections (HAIs). Centers for Disease Control and Prevention Web site. <http://www.cdc.gov/ncidod/dhqp/healthDis.html>. Updated February 23, 2006.
- ¹⁰ Lodié, Diag Micro Inf Dis, 2005
- ¹¹ Kaye K, Engmann J, Mozaffari E, Carmeli Y. Reference Group Choice and Antibiotic Resistance Outcomes. Emerg Infect Dis (serial on internet) 2004 June [date cited] available from <http://www.cdc.gov/ncidod/EID/vol10no6/02-0665.htm>
- ¹² Whitby et al., Med J Aust 2001;175:264-7 Whitby M, McLaws M-L, Berry G. The risk of death from methicillin resistant *Staphylococcus aureus* bacteraemia: a meta-analysis. Med J Aust 2001; 175: 264-267.
- ¹³ Salgado CD, Farr BM, What proportion of hospital patients colonized with methicillin-resistant *Staphylococcus aureus* are identified by clinical microbiology cultures? et al., ICHE Infect Control Hosp Epidemiol 2006;27:116-21
- ¹⁴ Lucet JC, Grenet K, Armand-Lefevre L, et al., High prevalence of carriage of methicillin-resistant *staphylococcus aureus* at Hospital admissions in elderly patients; Implications for Infection Control Strategies. Infection Control Hospital Epidemiology 2005;26:121-6
- ¹⁵ Understanding MRSA. WebMD. <http://webmd.com/skin-problems-and-treatments/understanding-mrsa-methicillin-resistant-staphylococcus-aureus>. Accessed march 9, 2008
- ¹⁶ Karchmer, CID TB, Editorial Commentary: Prevention of Healthcare-associated Methicillin-resistant *staphylococcus aureus* (MRSA) Infections: Adapting to a Changing Epidemiology, Clinical Infectious Diseases 2005;4115:167-9
- ¹⁷ Dietze B, Rath A, Wendt C, Martiny H. Survival of MRSA on sterile goods packaging. J Hosp Infect. 2001 Dec; 49 (4): 255-61
- ¹⁸ Hardy KJ, Oppenheim BA, Gossain S, Gao F, Hawkey PM. A Study of the Relationship Between Environmental Contamination with Methicillin-Resistant *Staphylococcus Aureus* (MRSA) and Patients' Acquisition of MRSA. Infection Control and Hospital Epidemiology. February 2006, Vol. 27 No. 2
- ¹⁹ Blythe D, Keenlyside D, Dawson SJ, Galloway A. Environmental contamination due to methicillin-resistant *Staphylococcus aureus* (MRSA). 1: J Hosp Infect. 1998 Jan;38(1):67-9. Comment in: J Hosp Infect. 1998 Jul;39(3):243-4.
- ²⁰ Boyce JM, Potter-Bynoe G, Chenevert C, King T. Environmental contamination due to methicillin-resistant *Staphylococcus aureus*: possible infection control implications. Infect Control Hosp Epidemiol. 1997 Sep;18(9):622-7.
- ²¹ Wagenvoort JH, Sluijsmans W, Penders RJ. Better Environmental survival of outbreak vs. sporadic MRSA isolates. J. Hosp Infect. 2000 Jul;45 (3):231-234

- ²² Guidelines for Environmental Infection Control and Healthcare Facilities Recommendations of CDC and Healthcare Infection Control Practices Advisory Committee (HICPAC) 2003. This is available from the Center for Disease Control and Prevention website www.cdc.gov.
- ²³ ACR Guidance Document for Safe MR Practices: 2007. AJR 2007; 188:1-27. http://www.acr.org/SecondaryMainMenuCategories/quality_safety/MRSafety/safe_mr07.aspx
- ²⁴ Gilk, T., Bell, R. The State of MRI Safety. Imaging Economics. Sept. 2007 http://www.imagingeconomics.com/issues/articles/2007-09_04.asp accessed March 9, 2008
- ²⁵ ACR Guidance Document for Safe MR Practices: 2007. AJR 2007; 188:1-27. http://www.acr.org/SecondaryMainMenuCategories/quality_safety/MRSafety/safe_mr07.aspx
- ²⁶ Sentinel Event Alert. Preventing accidents and injuries in the MRI suite. Issue 38, February 14, 2008. http://www.jointcommission.org/SentinelEvents/SentinelEventAlert/sea_38.htm
- ²⁷ ACR Guidance Document for Safe MR Practices: 2007. AJR 2007; 188:1-27. http://www.acr.org/SecondaryMainMenuCategories/quality_safety/MRSafety/safe_mr07.aspx Page 3.
- ²⁸ ACR Guidance Document for Safe MR Practices: 2007. AJR 2007; 188:1-27. http://www.acr.org/SecondaryMainMenuCategories/quality_safety/MRSafety/safe_mr07.aspx Page 23.
- ²⁹ ACR Guidance Document for Safe MR Practices: 2007. AJR 2007; 188:1-27. http://www.acr.org/SecondaryMainMenuCategories/quality_safety/MRSafety/safe_mr07.aspx pg. 23.
- ³⁰ Blythe D, Keenlyside D, Dawson SJ, Galloway A. Environmental contamination due to methicillin-resistant *Staphylococcus aureus* (MRSA). 1: J Hosp Infect. 1998 Jan;38(1):67-9. Comment in: J Hosp Infect. 1998 Jul;39(3):243-4.
- ³¹ Boyce JM, Potter-Bynoe G, Chenevert C, King T. Environmental contamination due to methicillin-resistant *Staphylococcus aureus*: possible infection control implications. Infect Control Hosp Epidemiol. 1997 Sep;18(9):622-7
- ³² Huang , SS, Mehta, S., Weed, D and Price, C.S. Methicillin-Resistant *Staphylococcus aureus* survival on Hospital Fomites. Infect Control Hosp Epidemiol 2006;27:1267-69 et al., Infect Control Hosp Epidemiol 2006;27:1267-69
- ³³ Lankford et al., Assessment of Materials Commonly Used in Healthcare: Implications for survival and transmission. Am J Infect Control 2006;34:258-63
- ³⁴ Martinez et al., Role of Environmental Contamination as a Risk Factor for Acquisition of Vancomycin-Resistant Enterococci in Patients Treated in a Medical Intensive Care Unit. Arch Intern Med 2003;163:1905-12 Arch Intern Med 2003;163:1905-12
- ³⁵ Huang, SS, Datta R, Platt, R. Risk of Acquiring Antibiotic-Resistant Bacteria From Prior Room Occupants. Arch Intern Med 2006;166:1945-51 et al., Arch Intern Med 2006;166:1945-51
- ³⁶ Huang, SS, Datta R, Platt, R. Risk of Acquiring Antibiotic-Resistant Bacteria From Prior Room Occupants. Arch Intern Med 2006;166:1945-51 Huang et al., Arch Intern Med 2006;166:1945-51
- ³⁷ Cosgrove SE, Qi Y, Kaye KS, Harbarth S, Karchmer AW, Carmeli Y. Infect Control Hosp Epidemiol. 2005 Feb;26(2):166-74. Comment in: Infect Control Hosp Epidemiol. 2006 Sep;27(9):994-5. The impact of methicillin resistance in *Staphylococcus aureus* bacteraemia on patient outcomes: mortality, length of stay, and hospital charges.
- ³⁸ Engemann JJ, Carmeli Y, Cosgrove SE, Clin Infect Dis. 2003 Mar 1;36(5):592-8. Epub 2003 Feb 7.Related Articles, Adverse clinical and economic outcomes attributable to methicillin resistance among patients with *Staphylococcus aureus* surgical site infection.
- ³⁹ Boyce P. Guideline for hand hygiene in health-care settings. MMWR Morb Mortal Wkly Rep 2002;51(16):1-44.[Medline]
- ⁴⁰ Delaney LR, and Gundersen, RB. Hand Hygiene. Biological & Pharmaceutical Bulletin. Vol. 28 (2005), No. 1 120
- ⁴¹ Kihlstrom J. Hand washing by health care providers. Institute for the Study of Healthcare Organizations & Transactions Web site. http://www.institute shot.com/hand_washing_by_healthcare_providers.htm.
- ⁴² Oie S, Yanagi C, Matsui H, Nishida T, Tomita M and Kamiya A. Contamination of Environmental Surfaces by *Staphylococcus aureus* in a Dermatological Ward and Its Preventive Measures. J Hosp Infect. 1998 Oct;40(2):135-40.
- ⁴³ Guidelines for Environmental Infection Control and Healthcare Facilities Recommendations of CDC and Healthcare Infection Control Practices Advisory Committee (HICPAC) 2003. This is available from the Center for Disease Control and Prevention website www.cdc.gov. section G no 2.
- ⁴⁴ Shiomori T, Miyamoto H, Makishima K, Yoshida M, Fujiyoshi T, Ueda T, Inaba T, Hiraki N. Evaluation of bedmaking-related airborne and surface methicillin-resistant *Staphylococcus aureus* contamination. J Hosp Infect. 2002 Jan;50(1):30-5

is published by the International Society for Magnetic Resonance in Medicine, and produced quarterly for the benefit of the SMRT membership.

SIGNALS NEWSLETTER COMMITTEE:

Julie Strandt-Peay, B.S.M., R.T., (R)(MR), Editor
 Anne Dorte Blankhom, M.Sc., R.T.
 Carolyn Bonaceto, B.S., R.T., (R)(MR)
 Cindy R. Comeau, B.S., R.T., (N)(MR)
 Janice Fairhurst, B.S., R.T., (R)(MR)
 Caron Murray, M.R.T., (R) AC, (CT)(MR)
 Anne Marie Sawyer, B.S., R.T., (R)(MR)
 Educational Seminars Editor
 Frank Shellock, Ph.D.
 Charles Stanley, R.T., (R)(CT)(MR)
 Nancy Talbot, M.R.T., (MR)(R)
 Pam Vincent, MPA, R.T., (R)(M)(CT)(MR)

PUBLICATIONS COMMITTEE:

Paul McElvogue, R.T., (R)(MR), Chair
 Carolyn Bonaceto, B.S., R.T., (R)(MR)
 Greg Brown, R.T.
 Cindy R. Comeau, B.S., R.T., (N)(MR)
 Ellen Condon, R.T.
 Cindy T. Hipps, B.H.S., R.T., (R)(MR)
 Bobbi Lewis, B.A., ARMRIT
 Anne M. Sawyer, B.S., R.T., (R)(MR)
 Mark Spooner, B.P.S., R.T., (R)(MR)(CT)
 Julie Strandt-Peay, B.S.M., R.T., (R)(MR)
 Pamela Vincent, MPA, R.T., (R)(M)(CT)(MR)

ELECTRONIC SUBMISSIONS COMMITTEE:

Pam Vincent, MPA, R.T., (R)(M)(CT)(MR), Chair
 Carolyn Bonaceto, B.S., R.T., (R)(MR)
 Cindy R. Comeau, B.S., R.T., (N)(MR)
 Gina Greenwood, MBA, R.T., (R)(MR)
 Vera Miller, B.S., R.T., (R)(MR)
 Steven P. Shannon, R.T., (R)(MR)
 Charles Stanley, R.T., (R)(CT)(MR)
 David Stanley, B.S., R.T., (R)(MR)

OFFICERS:

President:
 Wendy Strugnell, BAppSc(MIT)

President-Elect:
 Pamela Vincent, MPA, R.T., (R)(M)(CT)(MR)

Past-President:
 Carolyn Bonaceto, B.S., R.T., (R)(MR)

Secretary:
 Vera Miller, B.S., R.T., (R)(MR)

Treasurer:
 Steven P. Shannon, R.T., (R)(MR)

ISMRM Executive Director: Roberta A. Kravitz
 ISMRM Associate Executive Director: Jennifer Olson
 ISMRM Publications Director: Mary Keydash
 © 2007 by International Society for
 Magnetic Resonance in Medicine
 Phone: +1 510 841 1899
 Fax: +1 510 841 2340
 E-mail: smrt@ismrm.org
 SMRT Web Page: <http://www.ismrm.org/smrt>

2009: 28 FEBRUARY

SMRT ROCKY MOUNTAIN REGIONAL EDUCATIONAL SEMINAR

Denver, Colorado, USA

2009: 6-7 JUNE

ISMRM WEEKEND CASE-BASED CLINICAL EDUCATION PROGRAM

New York, New York, USA

2009: 12-13 SEPTEMBER

ISMRM WEEKEND CASE-BASED CLINICAL EDUCATION PROGRAM

Los Angeles, California, USA

2010: 6-7 FEBRUARY

ISMRM WEEKEND CASE-BASED CLINICAL EDUCATION PROGRAM

Miami, Florida, USA

UPCOMING



WORKSHOPS

14-17 February 2009



Advances in Musculoskeletal Magnetic Resonance Imaging

San Francisco, California, USA Workshop

25-28 January 2009



Data Sampling and Image Reconstruction

Sedona, Arizona, USA Workshop

23-26 October 2009



ISMRM Third International Workshop on Parallel MRI

Santa Cruz, California, USA Workshop

JOIN THE SMRT IN Honolulu



Announcing the Eighteenth SMRT Annual Meeting

in conjunction with
 the ISMRM Seventeenth Scientific Meeting & Exhibition

18-19 April 2009, Honolulu, Hawai'i, USA

Visit: <http://ismrm.org.smrt> for more information