Pediatric Oncologic Applications of Somatostatin Receptor Scintigraphy

by Geetika Khanna, MD, MS, Assistant Professor, Pediatric Radiology

$^{111}$In-DTPA (diethyleneetriaminepentaacetic acid)-octreotide is a radio-pharmaceutical widely used for visualization of somatostatin receptor positive tumors. High densities of somatostatin receptors have been identified in a variety of tumors such as gastro-enteropancreatic neuroendocrine tumors, embryonal tumors, meningiomas, and pituitary adenomas. Somatostatin receptor scintigraphy (SRS) is an established imaging technique in the diagnosis, staging, and follow-up of neuroendocrine tumors such as carcinoids and islet cell tumors (1). In the pediatric population, SRS has also been successfully used for differential diagnosis and surveillance of brain tumors.

CNS Applications

In the International Classification of Childhood Cancer (ICCC), pediatric central nervous system (CNS) tumors are divided into six subgroups, with the main diagnostic groups being: IIIa-ependymoma (8-14%), IIIb- astrocytoma (38-50%), IIIc- embryonal tumors (16-25%), and IIIId- other gliomas (4-16%) (2). Embryonal tumors, as a group, are the most malignant and comprise of the following subtypes: medulloblastoma, supratentorial primitive neuroectodermal tumors (PNET), atypical teratoid/rhabdoid tumors, medullopitethelioma, and ependymoblastoma.

Fig 1. Pre-operative prediction of tumor histology.

Case 1. 2-year-old boy with hydrocephalus (a) Axial T2-weighted image demonstrates an obstructing mass in the fourth ventricle, (b) SRS in the coronal plane shows intense uptake of octreotide in the posterior fossa mass (tumor to calvarium uptake ratio: 28) suggesting an embryonal tumor. This is a pathology proven medulloblastoma.

Case 2. (e) Axial T2-weighted image and (d) SRS in coronal plane in another 2-year-old boy with hydrocephalus shows a fourth ventricle mass with minimal uptake of octreotide (arrow) suggesting non-embryonal histology (tumor to calvarium uptake ratio:1.6). This is a pathology proven ependymoma. (Asterisk points to normal uptake in the clivus)
High densities of somatostatin receptors have been identified in embryonal tumors, and SRS has been successfully used to image these tumors (3). Despite tremendous advantages in displaying anatomic detail, the preoperative ability of conventional MRI and MR spectroscopy to predict tumor histology remains limited. Medulloblastoma, ependymoma, and pilocytic astrocytomas account for the three most common types of pediatric posterior fossa tumors. High expression of somatostatin receptors in medulloblastoma allows it to be distinguished from glial tumors using SRS (Fig 1) (4). In the supratentorial fossa, SRS can be used to differentiate primitive neuroectodermal tumors from high grade gliomas (5).

Perhaps even more important than the ability to differentiate embryonal tumors from glial tumors is the role of SRS in the surveillance of somatostatin receptor positive brain tumors. In spite of the advances in therapy, the prognosis of children with embryonal tumors remains poor with a five-year relative survival rate of 56%. Conventional MRI is the standard imaging modality for surveillance of brain tumors, but has limited ability in differentiating tumor from therapy related changes. Given the impracticality of sequential biopsies to monitor response to therapy in brain tumors, accurate imaging methods are needed for surveillance. SRS has been shown to improve the accuracy of surveillance scanning of SSTR positive tumors of childhood. In a series of 20 children with medulloblastoma, Muller, et al., found SRS to be true positive in 7 of 7 cases, true negative in 9 of 9 cases (including one with false positive MRI), false negative in only one patient with small drop metastasis, and false positive in no patient (4). Medulloblastoma is an infratentorial primitive neuroectodermal tumor (PNET), and it is similar on histologic examination to supratentorial PNET. Not surprisingly, supratentorial PNETs have also been shown to express high densities of SSTR and SRS has been used to identify early recurrence prior to the onset of clinical symptoms or tumor identification on MRI (5).

In our experience, the accuracy of surveillance imaging of somatostatin receptor CNS tumors can be improved by using SRS in combination with MRI, rather than MRI alone (6). In 4 out of 15 cases who had tumor recurrence in our series, the recurrence was initially detected on SRS alone as the MRI was negative in one patient due to hemorrhage in the tumor bed, could not differentiate between radiation necrosis and tumor in two patients, and could not differentiate between scar and recurrent tumor in one patient (Fig 2). The specificity of binding of Octreotide to SSTRs helped to improve specificity of surveillance imaging from 86% to 97% by differentiating enhancement due to scar from tumor related enhancement. Based on the above findings, we recommend the combined use of SRS and MRI in post-therapy follow-up of SSTR-positive tumors of childhood.

Other Applications

Somatostatin receptor scintigraphy has been successfully used to image a variety of neural crest tumors in the pediatric population such as carcinoids, paragangliomas, and neuroblastoma. Patients with neuroendocrine tumors are often misdiagnosed and the average time from initial onset of symptoms to diagnosis can be several years. It is an extremely sensitive technique in the evaluation of gastroenteropancreatic neuroendocrine tumors, both for tumor detection and staging. The availability of SPECT/CT has helped to improve the diagnostic accuracy of SRS. In addition, SRS has also been shown to have prognostic significance in the evaluation of neuroblastoma patients.


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Sectional Update
Neuroradiology Division: 5 Years Later (2001-2006)

by Wendy R.K. Smoker, MS, MD, FACR, Professor, Director of Neuroradiology, Co-Director of MRI

The past five years have seen many changes and advancements in the Neuroradiology Division. We are very fortunate to be currently staffed with seven neuroradiologists and three physicists. Our newest members, Drs Theodore (Ted) Donata, MD, PhD, and Bruno Policeni, MD, joined us this past July following completion of fellowships in our Division. We have expertise in MR diffusion/perfusion imaging, spectroscopy, diffusion tensor imaging /tractography, phase-contrast CSF flow assessments, and CT perfusion. We offer our clinical colleagues expertise in all areas of neuroradiology and head and neck radiology.

During the past five years we received an unrestricted, 5-year accreditation for our ACGME Neuroradiology fellowship. We currently have 3 ACGME fellows and have filled our fellowship slots for 2007. Also, this past year we received approval for a new, dedicated Head and Neck Radiology fellowship and the ABR has recently recognized this fellowship as fulfilling the requirement of a second year of neuroradiology for purposes of taking the Certificate of Added Qualification in Neuroradiology.

This is the first formal head and neck fellowship in the United States and the first approved by the ABR. With approximately 30% of our patients referred for head and neck imaging from our highly ranked Otolaryngology and Ophthalmology colleagues, this fellowship would allow concentrated exposure to head and neck pathology, culminating in an advanced level of expertise.

Tremendous growth in volume, technology, and equipment has occurred over the past few years. Our MR volume has grown by approximately 30% and our CT volume has grown by approximately 25%. Three years ago we occupied a small reading room with an alternator and five PACS workstations. Today, we are in the largest of our new reading rooms, equipped with eight PACS workstations, two 3-D Vitrea workstations, our E-film workstation, and, of course, one alternator! When the MR renovations are complete, we will occupy a portion of another reading room in which we will have two additional PACS workstations.

Three years ago we had three (2 very old!) MR scanners. Today, 2 of these have been replaced and we currently have a total of five 1.5T and one 3T MR scanners. We perform diffusion tensor imaging on all patients. We offer perfusion imaging, often with MR angiography, on all stroke patients. Suspected tumor patients are also evaluated with perfusion imaging, with the addition of spectroscopy when needed.

We currently have six CT scanners in operation and a seventh (continued on next page)
is expected later this year. We have recently begun refining our techniques for CT perfusion and employ this modality for suspected vasospasm in patients with aneurysmal subarachnoid hemorrhage with the expected use in many acute stroke patients. Our CTA volume steadily increases as more and more noninvasive vascular angiography is the norm. We have recently acquired new software on our independent workstations that enables us to perform improved 3-D post processing. Our referring physicians are now able to view their patients’ studies on their own computers and on computers situated in all clinics throughout the hospital within minutes of study completion. We strive to offer state-of-the-art imaging services to our clinical colleagues.

We continue to advance medicine through discovery and dissemination of new ideas. Over the past five years, members of the Neuroradiology Division have presented 108 invited lectures, refresher courses, or proffered papers at a variety of national and international meetings. Members of the division have authored or co-authored 112 scientific or educational exhibits, many of which received awards, including: Bronze Medal (ARRS); Silver Medal (ASHNR); First, Second, and Third place awards (ASHNR); 2 Summa Cum Laude Awards (ASNR and RSNA); 8 Magna Cum Laude Awards (ASNR and RSNA); and 11 Certificates of Merit (RSNA). Two years ago, Dr. Toshio Moritani’s book, “Diffusion-Weighted MR Imaging of the Brain” was published and last year he completed translation of his book into Japanese. In the past five years, members of the division have also authored or co-authored 75 peer-reviewed scientific papers.

It is clear that, during the past five years, the Neuroradiology Division has seen tremendous growth in faculty (including fellows), equipment, volume of studies, and scientific productivity. We look forward to continued growth and new horizons in the next five years!

Neuroradiology Update, continued from previous page

Education Update, continued from previous page

will be incorporated into the Iowa Radiological Society annual meeting beginning in the fall of 2007. A new position, Director of Resident Research, has been established that will oversee the integrated 4-year curriculum and report to the residency director.

Finally, in an effort to offer medical students more exposure to the practice of radiology, we are beginning Radiology Externship for Medical Students. In this program, the student will be on-call with the senior radiology resident and carry the on-call pager. Working with the resident, they will develop a better understanding of the practice of radiology as well as the skills of triaging patients and allocating resources. This program will also allow for additional learning opportunities for both the residents and students as they interact throughout the call.

Radiology is one of the fastest growing areas in medicine. Through constant evaluation and innovative curricula, we will ensure that our educational programs keep pace.

Pediatric Oncologic Applications, continued from page 2


Welcome New Faculty!

Hicham T. Abada, MD, joined the Department of Radiology as a Clinical Associate Professor in the Interventional section. Dr. Abada received his MD from the Medical University of Algiers and completed a Radiology residency and Interventional fellowship at the University of Brussels in Brussels, Belgium. Prior to his appointment at UIHC, he was a Consultant Interventional Radiologist at René Dubos Hospital, Cergy-Pontoise, France.

Kelli Andresen, MD, Clinical Assistant Professor, completed her medical education from The University of Iowa Carver College of Medicine and her Radiology residency at Mayo Graduate School of Medicine in Rochester, MN. Most recently, she completed a fellowship in Body Imaging in the Department of Radiology at UIHC. Dr. Andresen joins the faculty of the Body Imaging section.

Yoshiki Asayama, MD, joined the Department of Radiology as a Visiting Assistant Professor. He received his medical training at Kyushu University, Fukuoka, Japan. He is also currently on staff there. Dr. Asayama completed his Radiology postgraduate education at Saga Prefectural Hospital, Kyushu University, and Saiseikai Yahata General Hospital. He joins the faculty of the Body Imaging section.

Theodore S. Donta, PhD, MD, Clinical Assistant Professor, received a PhD in Neurosciences at University of Connecticut Health Center, Farmington, CT, before receiving his medical training at Boston University, Boston, MA. He completed both his residency in Diagnostic Radiology and a fellowship in Neuroradiology at UIHC. Dr. Donta joins the faculty of the Neuroradiology section.

Jae Young Lee, MD, PhD, joined the Department as a Visiting Assistant Professor in the Body Imaging section. He received his medical training at the Seoul National University College in Seoul, Korea. He subsequently completed his graduate work, Radiology residency and fellowship from the same institution. Prior to his appointment at UIHC, he was a Clinical Assistant Professor at Seoul National University, College of Medicine.

Bruno Policeni, MD, Clinical Assistant Professor, completed both his medical education and Radiology residency at Faculdade de Medicina de Valenca College of Medicine, Valenca, Rio de Janeiro, Brazil. Prior to his appointment, Dr. Policeni also completed a Neuroradiology fellowship at UIHC. He joins the faculty of the Neuroradiology section.

In addition to our new faculty appointments, we would also like to welcome the following fellows:

**Body Imaging**
- Archana T. Laroia, MD, Fellow-Associate
- Jason R. Martin, MD, Fellow-Associate

**Interventional**
- Sandeep T. Laroia, MD, Fellow
- Chirag V. Patel, MD, Fellow

**Mammography**
- Maheen Rajput, MD, Fellow
- Baron Adkins, MD, Fellow

**Musculoskeletal**
- Marc R. Beck, MD, Fellow-Associate
- Mehul M. Doshi, MD, Fellow-Associate
- Earl B. Maes, MD, Fellow-Associate
- David J. Rideout, MD, Fellow-Associate

**Neuroradiology**
- Vikas Jain, MBBS, Fellow
- Marc Tobler, MD, Fellow
- Andy N. Ellingson, MD, Fellow

**Neurointerventional**
- Masanari Omizuka, MD, Fellow
- Luis Arangua, MD, Fellow

**Nuclear Medicine**
- Luke Bolek, MD, Fellow
Monzer M. Abu-Yousef, MD
- Recipient of Distinguished Service Award from the American Board of Radiology for services provided to the ABR over the last 15 years, May 2006.
- Nominated as one of the most effective Radiology researchers by the Society of Aunt Minnie’s
- Received Commendation Plaque from the American Institute of Ultrasound (AIUM) in Medicine for services to the society in the capacity of “General & Abdominal Ultrasound Section” Chairman, March 2006
- Nominated for the Board of Directors for the AIUM, August 2006
- Moderator: Genito-urinary Ultrasound Update and Bowel US Update categorical courses, 51st annual AIUM meeting, March 2006
- Chair, GU ultrasound abstract reviewer for the 51st AIUM annual meeting, March 2006

D. Lee Bennett, MD
- Medical student, Lisa Fettkether, was awarded a 2006 Research Day General Award for her work entitled, “Patient Comprehension of Informed Consent for Joint Injection Procedures.” Dr. Bennett mentored her on the project.

Theodore S. Donta, MD
- Recipient of the University of Iowa Hospitals and Clinics “Above & Beyond” award for exceptional patient care.

Georges Y. El-Khoury, MD
- Member, Consulting Editorial Board of the journal, Skeletal Radiology, January 2006
- Examiner, American Board of Radiology, November 2006

Geetika Khanna, MD
- Earned Master of Science degree in Clinical Investigation, Graduate College, University of Iowa, Iowa City, IA, June 2006
- Recipient of American College of Radiology Imaging Network Chair’s Institutional Achievement Award for participation in ACRIN-6660 trial as site PI, September 2006

Brian E. Mullan, MD
- Appointed by RSNA to lead the RSNA International Visiting Professors delegation to the Pan African Congress of Radiology in Kampala, Uganda, September 12-22, 2007
- Reappointed as Director of RSNA/ARRS/AUR Introduction to Research Seminar for 2nd-year residents at RSNA

Jeong Mi Park, MD
- Former UI medical student, Bradley Mullen, who worked with Dr. Park on a cancer study was awarded the 2005-2006 Gillies Outstanding Senior Medical Student award for the work.

Wendy R. K. Smoker, MD
- 2006-2007 Neuroradiology Faculty/Lecturer, Armed Forces Institute of Pathology.
- Maintenance of Certification in Diagnostic Radiology

William Stanford, MD
- Receipient of Editor’s Recognition Award for Reviewing with Distinction from the journal, Radiology.

Edwin J.R. van Beek, MD
- 2006-2007 Program Committee Member, Joint Meeting of the European Society of Thoracic Imaging/Fleischner Society, Athens, Greece.
- Recipient of the 2006 American Society of Reproductive Medicine In-Training Award (R. Shroff) for abstract, “Multislice cardiac CT detects early coronary artery disease in young women with polycystic ovary syndrome.”

Neuroradiology Section Makes Strong Showing at National Conferences
American Society of Neuroradiology Annual Meeting San Diego, CA. May, 2006
Policeni BA, Smoker WRK, Kao S, Casselman JW. Aggressive fibromatosis of the submandibular space. CUM LAUDE AWARD

Moritani T, Smoker WRK, Oka M, Kirby P, Kim J, et al. Usual and unusual imaging findings in glioblastoma multiforms (GBM) and their pathologic basis. CUM LAUDE AWARD

Moritani T, Smoker WRK, Donta T, Policeni B, Wolfe D, Kademian J, Lee HK, Sato Y. Usual and unusual imaging findings and pitfalls in cerebral venous thrombosis. CUM LAUDE AWARD


Bergin J, Gentry LR, Smoker WRK, Reede DL, Pyle GM. Comprehensive diagnostic evaluation of temporal bone trauma. MAGNA CUM LAUDE AWARD

American Society of Head and Neck Radiologists Annual Meeting Phoenix, AZ. September, 2006
Weldon D, Smoker WRK, Ginsberg L, Gentry LR, Lee HK. Anatomy and pathology of common and uncommon pathways of perineural tumor. FIRST PLACE AWARD

Smoker WRK, Policeni B, Gentry LR, Moritani T, Lee HK. Doctor! I have a crick in my neck! The causes and assessment of basilar invagination. THIRD PLACE AWARD
William Stanford, MD, Receives Gold Medal from the North American Society of Cardiac Imaging

Dr. William Stanford, Professor-Emeritus, was awarded the North American Society of Cardiac Imaging Gold Medal for his outstanding contributions in the field of cardiac imaging at the Society’s annual meeting in Las Vegas on October 9, 2006. Dr. Stanford was recognized for his research in electron beam CT and helical CT imaging of coronary artery disease and especially coronary artery calcification. The North American Society of Cardiac Imaging (NASCI) is one of the premier societies in cardiovascular disease imaging.

Radiologic Technology Students Win ISRT Essay Competition!

The RT Program recently had 9 students submit essay papers to the Iowa Society of Radiologic Technology essay competition. Three of the students were asked to present during their fall meeting. They won 1st, 2nd, and 3rd places on their essays:

1st: Emily Petersen, “Brain Aneurysms”
2nd: Jaimee Johnson, “Technology Bursting Old Ideas That All Aneurysms Are Deadly”
3rd: Katie VandenHull, “Troralogy of Fallot”

Each also had their essay published in the Hawkeye Static News. Congratulations!!

2006 Radiology Teaching Awards

Department of Radiology Faculty Voted “Best Doctors in America”

UI Radiology faculty were again included in the “Best Doctors in America” database for 2006. Best Doctors are voted in by their peers. Surveys are sent to 35,000 physicians who rate their fellow doctors on their clinical abilities. The following UI Radiology faculty included this year are:

Diagnostic Radiology: Bruce P. Brown; John C. Chaloupka; George Y. El-Khoury; Laurie L. Fajardo; E. A. Franken Jr.; Yutaka Sato; Wendy R. K. Smoker

Nuclear Medicine: David L. Bushnell; Michael M. Graham; Daniel Kahn; Yusef Menda
The print version of this page contains a listing of contributors to the Department of Radiology for the period of January 1, 2005 through June 30, 2006. If you wish to receive a print copy, please contact Nichole Jenkins at (319) 353-8690. Thank you.
**Publications**

**Books/Book Chapters**

(continued on next page)
• Malkin CJ, Pugh PJ, West JN, van Beek EJR, Jones TH, Channer KS. Testosterone Therapy in Men with Heart Failure: A Double Blind Placebo Controlled Trial. Eur Heart J. 2006;27:57-64.


• Sampson FC, Goodacre SW, Thomas SM, van Beek EJR. The accuracy of MRI in diagnosis of suspected deep vein thrombosis: systematic review and meta-analysis. Eur Radiol. 2006 [E-pub ahead of print].


(continued on next page)

Scientific Presentations/Abstracts

• Bennett DL. Trauma and the Thoracic Cage. Fall Meeting of the Iowa Radiological Society, Iowa City, September 8-9, 2006.
• El-Khoury GY. Reading Cases with the Experts. Annual Meeting of the American Roentgen Ray Society, Vancouver, BC, Canada, April 30-May 5, 2006.
• Ireland RH, McJury M, Hatton MQ, Woodhouse N, van Beek EJ, Wild JM. The role of hyperpolarized 3-helium MRI in NSCLC. Proc 14th Annual Scientific Meeting, ISMRM, Seattle, USA:1662.


• Michael SL, O’Dorisio MS, Khanna G, Menda Y, O’Dorisio T, Madsen MT, Bushnell DL. Diagnosis and Treatment of Children and Young Adults with Tumors Arising from Neural Crest and Neuroepithelial Precursors. Pacific NW Carcinoid/NET Physician Symposium, Portland, OR, September 30, 2006.


(continued on next page)
Scientific Presentations/Abstracts, continued from previous page

- Van Beek EJR. CT and MR imaging of neoplastic diseases. (cardiothoracic refresher course) Eur Radiol 2006;16 (suppl 1):141.
- Woodhouse N, Wild JM, van Beek EJ, Elliot C, Griffiths PD, Paley MN, Kiely DG. Intra-individual comparison of 0.5 & 1.0M contrast agents in the evaluation of chronic thromboembolic pulmonary hypertension. Proc 14th Annual Scientific Meeting, ISMRM, Seattle, USA: 1956.

Invited Speakers

- Bennett DL. MRI of the Knee. Iowa Society of Radiologic Technologists Annual Meeting, Iowa City, IA, April 7, 2006.
- Bushnell DL. Nuclear Medicine for Thyroid Disease. 39th Annual Iowa Head and Neck Cancer & Reconstructive Surgery Course, Iowa City, Iowa, June 12-17, 2006.
- Graham MM. 1) Advances in Molecular Imaging of Cancer. 2) Future Requirements for Educational Programs in Nuclear Medicine and Nuclear Medicine Technology. Central Chapter of the Society of Nuclear Medicine, Indianapolis, IN, March 24-26, 2006.
- Graham MM. 1) Head and Neck. 2) The Impact of PET/CT. 31st Annual Western Regional Society of Nuclear Medicine, Reno, NV, October 5-8, 2006.
- Graham MM. PET CT of the Head and Neck. 1) Society of Nuclear Medicine Mid-Winter Educational Symposium, Tempe, AZ, February 11-12, 2006. 2) Association of University Radiologists Annual Meeting, Austin, TX, April 5-8, 2006.
- Graham MM. PET/CT Imaging of Head and Neck Cancer. 1) Nuclear Medicine 2006: Montefiore Medical Center/Albert Einstein College of Medicine, New York, NY, November 2-5, 2006. 2) Stanford University, Stanford, CA, September 4-6, 2006.
• Magnotta VA. Validation of Bone Models using 3D Surface Scanning. The National Alliance for Medical Image Computing All Hands Meeting, Salt Lake City, Utah, January 8, 2006.

• Maley JE. A3C2R2/APDR/SCARD/APCR Joint Session: The Brogden Panel Discussion (Job Expectations for Chief Residents) Association of University Radiologists 54th Annual Meeting, Austin, TX, April 5, 2006.


• Mullan BF. 1) Inside a radiologist’s head – an approach to chest radiographs. 2) Miscellaneous rumbles – an approach to the abdominal radiograph. Spring Nurse Practitioner Conference. The University of Iowa College of Nursing. April 27, 2006. Iowa City, IA

• Mullan BF. 1) Physiologic Interpretation of the chest radiograph – lessons from the cleaning lady. 2) Intestinal lung disease – or why no one talks to Uncle Ralph at the family picnic. 3) Cryptogenic Idiopathology: cases from the vault. [Distinguished Visiting Professor] Wayne State University, Detroit Medical Center, Detroit, MI, January 11, 2006.

• Stanford W. 1) Plain Film Imaging of Acquired Heart Disease. 2) CT Imaging of Pulmonary Embolism: Should this not be the definitive study? Iowa Society of Radiologic Technologists, Iowa City, IA, April 8, 2006.

• Stanford W. Imaging of coronary artery disease: The changing role of calcium. [Visiting Professor] Wake Forest University, College of Medicine, Department of Radiology. Winston-Salem, NC, May 10, 2006.


• Stanford W. Radiology of Right Heart Dysfunction, Part II. Department of Radiology Teaching Conference, UIHC, Iowa City, IA, April 3, 2006.


Invited/Refresher Course Faculty

• D'Alessandro MP, D'Alessandro, DM. 1) Lessons Learned From the Life Cycle of a Digital Library: The Virtual Hospital. 2) Steps to Success fully Creating and Operating Your Own Medical Education Web Site. 3) Medical Educator's Portfolios: How to be Recognized and Promoted for Your Computer-Based Medical Education Scholarship. Slice of Life 2006 18th International Meeting for Medical Multimedia Developers and Educators. Lausanne, Switzerland, July 4-8, 2006.

• El-Khoury GY. 1) Interesting Case Conference. 2) Newer Trends in Imaging of Cervical Spine Trauma. Siouxland Medical Education Foundation, Sioux City, IA, October 19, 2006.


• Smoker WRK. 1) Appearance of common neoplasms of the brain with CT and MR imaging. 2) Anatomy and oncologic pathology of the neck on CT and MR with emphasis on nodal anatomy and pathology. Society of Nuclear Medicine Annual Meeting. San Diego, CA. June 2006


• Smoker WRK. Lower cervical spine trauma. Iowa Society of Radiologic Technologists Annual Spring meeting. Iowa City, Iowa. April 2006.

• Smoker WRK. Normal Anatomy and pathology of the temporal bone. Otolaryngology—Head and Neck Surgery, Basic Science Course, The University of Iowa Hospitals and Clinics, Iowa City, IA August 2006.


Scientific Posters/Exhibits


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Scientific Posters/Exhibits, continued from previous page


Grants

PI: Jeong Mi Park, MD
A multicenter, controlled clinical trial to evaluate the Hologic 3-D Tomosynthesis Mammography System used in conjunction with conventional 2-D digital mammography
Source: Hologic Co.
Direct Funds: $357,510
Grant Duration: 04/2006-03/2007