

44TH ANNUAL MEETING

TECHNOLOGIST SECTION PROGRAM

Proceedings of the 44th Annual Meeting of
The Society of Nuclear Medicine
June 1-4, 1997 • San Antonio, Texas

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1997 SCIENTIFIC AND TEACHING SESSIONS COMMITTEE

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44TH ANNUAL MEETING PROGRAM INFORMATION

GENERAL INFORMATION:

Registration

Registration will be held in the South Exhibit Hall at the San Antonio Convention Center from Saturday, May 31 through Thursday, June 5. Attendees will be able to pick up their preregistration materials or register on-site.

Registration Hours:

San Antonio Convention Center

Saturday, May 31, 1997	3:00 p.m.–7:00 p.m.
Sunday, June 1, 1997	7:00 a.m.–5:00 p.m.
Monday, June 2, 1997	7:00 a.m.–5:00 p.m.
Tuesday, June 3, 1997	7:00 a.m.–5:00 p.m.
Wednesday, June 4, 1997	7:00 a.m.–5:00 p.m.
Thursday, June 5, 1997	7:00 a.m.–11:00 a.m.

Please note that name badges are required for admission into the Exhibit Hall, all educational meetings and social events. Children under the age of 12 will not be admitted into the Exhibit Hall.

NOTE

Due to copyright restrictions and other legal issues, only the contractor authorized by the Society of Nuclear Medicine, which has obtained written permission from the presenters, may be permitted to audiotape or videotape scientific sessions. All other audiotaping or videotaping is strictly prohibited.

SNM MESSAGE CENTER

The Society of Nuclear Medicine will staff a booth in the registration area to provide information about SNM activities at the Annual Meeting and to help attendees with any problems or questions. Messages for meeting attendees will be posted daily from 8:00 a.m.–5:00 p.m., Monday, June 2 through Wednesday, June 4 and until 12:30 p.m. Thursday, June 5.

SOCIETY AND TECHNOLOGIST SECTION COMMITTEE MEETINGS

Committee meetings will convene in the San Antonio Convention Center. All members are cordially invited to attend.

Technologist Section Meetings

Committees: Thursday, May 29

National Council: Friday, May 30

Business Meeting: Wednesday, June 4

Society Meetings

The following SNM committees are scheduled to meet on Friday, May 30: Council Presidents, Committee Chairs, Chapter Presidents and Board of Directors.

Committees: Saturday, May 31

House of Delegates: Sunday, June 1

EXHIBIT HALL VIEWING HOURS

Monday,	10:30 a.m.–5:00 p.m.
Tuesday	10:00 a.m.–5:00 p.m.
Wednesday	10:00 a.m.–5:00 p.m.
Thursday	8:00 a.m.–noon

SNM PUBLICATIONS AND MEMBERSHIP BOOTHS

SNM books will be on sale from 10:00 a.m. to 5:00 p.m. Sunday–Wednesday, and from 8:00 a.m. to 12:30 p.m. Thursday at the publications booth. In addition, staff members for *The Journal of Nuclear Medicine* and the *Journal of Nuclear Medicine Technology* will be on hand to answer questions.

Members and nonmembers are encouraged to stop by the membership booth Sunday, June 1 through Thursday, June 5 during registration hours.

SPECIAL EVENTS AND SOCIAL ACTIVITIES:

Awards Presentation, SNM Business Meeting and Wine and Cheese Reception

Monday, June 2, 5:30 p.m.–7:00 p.m., San Antonio Convention Center

Technologist Section Business Meeting/Scientific Award Ceremony

Wednesday, June 4, 12:30 p.m.–2:00 p.m., San Antonio Convention Center

1997 Technologist Party

Wednesday, June 4, 8:00 p.m.–12:00 a.m., San Antonio Marriott Rivercenter

Scientific Meeting Highlights

Thursday, June 5, 11:30 a.m.–12:30 p.m., Lila Cockrell Theatre, San Antonio Convention Center

CONTINUING EDUCATION

The SNM Annual Meeting is intended for all nuclear medicine physicians, scientists, pharmacists and technologists.

Continuing Education Information for Technologists

The SNM Technologist Section, through its VOICE program, has approved qualified courses at this meeting for a maximum of 32.75 CEH (continuing education hours). VOICE-approved credit is recognized by most licensure states and by the ARRT (as Category A credit). The program will also be submitted to the Florida HRS for approval.

Meeting registrants will each receive a continuing education packet of information. To obtain credit for attending this meeting, technologists must complete the Technologist Credit Reporting Form and the General Evaluation Form located in this packet. Report only those lectures at which you were present for 80% of the presentation. Technologists are also to complete and submit individual evaluation forms at each session they attend.

At the end of the meeting, SNM-TS members (and NMVTP participants) are to leave the completed Credit Reporting Form and General Evaluation Form at the Continuing Education Booth (located near Registration). Non-SNM-TS members are to leave the evaluation forms only and keep the Reporting Form and Attendance Certificate (found in their registration packet) for their records.

Continuing Education Information for Physicians and Pharmacists

The Technologist Section of the SNM is offering continuing medical and pharmaceutical education credits for many of its continuing education sessions. All physicians and pharmacists are invited to participate. Certificates of completion will be mailed to physicians and pharmacists who complete and submit the appropriate documentation, within a month of the meeting.

Accreditation Statements

ACCME

The Society of Nuclear Medicine is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to sponsor continuing medical education for physicians.

AMA/PRA Designation Statement

The Society of Nuclear Medicine designates this educational activity for up to 32.75 hours in Category 1 credit towards the AMA Physician's Recognition Award. Each physician should claim only those hours of credit that they actually spent in the educational activity.

ACPE

The Society of Nuclear Medicine is approved by the American Council on Pharmaceutical Education (ACPE) as a provider of continuing pharmaceutical education. The ACPE Universal Program Numbers for this meeting are: 210-000-97-003-L01 (14.0 hours) and 210-000-97-004-L04 (24 hours).



Listed below are the Technologist Section continuing education courses approved for CPE credit. In the Program/Show Directory, these courses will be identified by CPE.

210-000-97-003-L01 (Drug Therapy): Oncology: Nuclear Medicine's Role in Detection, Treatment and Pain Management (2.75).

210-000-97-004-L04 (General Pharmacy): The Internet for Beginners (4.0); Quality Control (QC) of Scintillation Detectors Road Show (2.75); Skills for the Nuclear Cardiology Technologist (6.5); Clinical Research in Nuclear Medicine (3.0); Nuclear Cardiology I: Introduction (1.5); Cent\$ and Sensibility: How to Survive and Thrive in a Changing Payer Environment (3.0); Radiation Safety (3.0); Nuclear Cardiology IV: Update on New Imaging (1.5); Optimizing the Art of Clinical NeuroSPECT Technology (3.0).

Grievance Policy

The SNM has the following grievance policy in place concerning continuing pharmaceutical education:

If participants are not satisfied with the program, they must submit a complaint no later than 90 days after the program. Participants should state in detail why the program attended was not satisfactory. If participants feel that the program did not meet its objectives, this should be clearly stated. Also, if participants feel that the program was misrepresented, they should state this clearly. (Please note that not meeting the objectives does not always warrant a refund.)

The complaint is then forwarded by the SNM to the course organizer. The organizer then carefully reviews the complaint and, if necessary, contacts the author of the complaint for further details. The organizer

then decides whether the complaint is strong enough to deserve a refund. The organizer then reports the results to the SNM. If a refund is issued, it excludes the processing fee of the registration.

Continuing Education Contacts

SNM Education Department, 1850 Samuel Morse Drive, Reston, VA 20190-5316; phone: 703-708-9000:

Marcia Ferg x210, email: mferg@snm.org

Jim Simpson x230, email: jsimpson@snm.org.

ABSTRACTS ACCEPTANCE/REJECTION AND JUDGING CRITERIA

Many people have asked to see in writing the criteria on which the decision to accept or reject abstracts is made. In an attempt to standardize the criteria and make the process as objective as possible, the Scientific and Teaching and Awards Committees of the Technologist Section offer the criteria used this year.

Basic Requirements

1. Abstracts must be an original idea, new concept or an improvement of an old idea. Case studies are not acceptable.
2. Abstracts could not represent works in progress.
3. All abstracts would be considered, but only those abstracts whose primary author and presenter is a technologist would be considered for technologist awards.

Judging Acceptance

1. Each abstract was sent to five reviewers for scoring.
2. Scoring was 1 through 5, with 1 being the lowest score and 5 being the highest score. Tenths of points could be used.
3. Abstracts had to receive an overall average score of 3.0 to be considered for oral or poster presentation.
4. The judging categories for acceptance/rejection are the same as for final judging of awards as below:
 - A. Scientific merit
 - B. Organization
 - C. Practicality
 - D. Presentation
 - E. Technical quality.
5. Each category, above, was given a numerical score, the total score summed and the average calculated. This average score was recorded for each abstract for each of the five reviewers. The abstract was deemed acceptable if the average of the five reviewers was 3 or above.
6. If the abstract was accepted, then the decision of presentation as an oral or poster was made by majority decision of the five reviewers. In case of a tie, the final decision was at the discretion of the Scientific and Teaching Chair.

Technologist Section Matrix 1997

Times	Room 207	Room Fiesta B&C	Room 101 A&B	Room 206	Room 205
SATURDAY, May 31					
8:30-2:30	Internet (Fiesta E) / ACLS (205)				
SUNDAY, June 1					
8:30-2:30	CATEGORICALS: Cardiology (Fiesta B&C) / Internet (Fiesta E) / QC Scintillation Detectors (Fiesta D) / ACLS (205)				
MONDAY, June 2					
8:30-10:00	PLENARY SESSION				
10:00-11:30	Exhibit Hall is Open				
11:30-12:30	LUNCH				
12:30-2:00		Clinical Research in Nuclear Medicine	Been There, Done That- Marketing Projects	JRC Workshop - (Marriott Rivercenter)	Cardiology/Instrumentation & Data Analysis Papers
2:00-2:15	Exhibits / Break				
2:15-3:45		Research: How to Prepare an Abstract	Changing the Workplace Culture		Instrumentation & Data Analysis Papers
TUESDAY, June 3					
8:00-9:30		Gastrointestinal (Fiesta E)	Oncology	Educator's Forum: NMTCB	Pulmonary/Bone/Renal Papers
9:30-9:45	Exhibits / Break				
9:45-11:15		Universal Precautions for Nuclear Medicine	Oncology	Educator's Forum: Testing Psychometrics	Neurosciences Papers
11:15-12:30	LUNCH / Exhibits				
12:30-2:00		Cent\$ and Sensibility	Radiation Safety	Student Papers	Hematology/Oncology Papers
2:00-2:15	Exhibits / Break				
2:15-3:45		Cent\$ and Sensibility	Radiation Safety		Hematology/Oncology Papers
WEDNESDAY, June 4					
8:00-9:30		NeuroSPECT: Brain	Non-Nuclear Skills/Competencies		Item Writer's Workshop
9:30-9:45	Exhibits / Break				
9:45-11:15		NeuroSPECT: Brain	Non-Nuclear Skills/Competencies		Item Writer's Workshop
11:15-12:30	LUNCH / Exhibits				
12:30-2:00	TECHNOLOGIST AWARDS AND BUSINESS MEETING (Rm: Fiesta B&C) - ALL INVITED				
2:00-2:15	Exhibits / Break				
2:15-3:45		Historical Perspective of 511 keV	Health Care Policy		Item Writer's Workshop

* Rooms and times may change.

ABSTRACT OF SCIENTIFIC PAPERS

A Note on Scientific Papers

The Scientific and Teaching Sessions Committee of the Society of Nuclear Medicine—Technologist Section is pleased to present the scientific paper abstracts for the 44th Annual Meeting. The scientific papers will be presented commencing Monday, June 2 in sessions beginning at 12:30 p.m.

MONDAY, JUNE 2, 1997

Formal Opening and Plenary Session

8:30–10:00 a.m.

North Banquet Hall

A continuous slide/tape presentation of the commercial fellowship winners will be played: DuPont Pharmaceutical Fellowships, Mallinckrodt Research and Development Fellowship and Medi-Physics Research Fellowship.

8:00 Welcome

Michael D. Devous, Sr., PhD
William C. Eckelman, PhD
Martha Pickett, CNMT

8:35 Henry Wagner Lectureship

Presentation of lecture by Michael Maisey, MD

9:05 Meeting Preview

Michael D. Devous, Sr., PhD
Thomas F. Budinger, PhD

9:30 Georg de Hevesy Award

Introduction of William C. Eckelman, PhD and presentation of award by Michael Welch, PhD

9:45 Paul C. Abersold Award

Introduction of Joanna Fowler, PhD, and presentation of the award by Alfred P. Wolf, PhD

10:00 Closing by Michael D. Devous, Sr., PhD

Opening of the 1997 SNM Exposition: Exhibit Halls, San Antonio Convention Center.

MONDAY, JUNE 2, 1997

Session 201

Cardiology, Instrumentation and Data Analysis

12:30–2:00 p.m.

Room: 205

No. 1400

Development of the method for excluding artifact in myocardial SPECT with ^{99m}Tc -labeled contrast agent for myocardial circulation imaging
Masao.Funahashi, Kazuyuki.Kashiyama, Ryuichi.Shimizu, Shuuzou.Machida, Kazuyuki.Izumi, Kazuhiro.Mihara
Osaka Prefectural Hospital, Japan

It is known that ^{99m}Tc -labeled contrast agent for myocardial circulation imaging has a highly cumulative property in the liver and gall bladder, and accumulation in the gall bladder becomes the origin of radially expanding streak artifact, in particular. However, the mechanism of generation of this artifact has not been reported yet. In this study, we clarified the mechanism of generation of this artifact, and developed the method for excluding this artifact. Imaging was performed with a PRISM3000 of Picker Co. ODYSSEY1500/750 Version 5.4 was used for image processing. In order to examine the cause of the artifact, a water phantom (diameter: 21 cm) was used. A plastic syringe (Terumo Co.) filled with $^{99m}\text{TcO}^+$ was placed in the center of the phantom, and the mechanism of generation of the artifact was examined by changing the diameter of the syringe, radioactivity and background radioactivity. 1) When syringes with the same diameter were used, stronger artifact was generated with increasing specific radioactivity. 2) At a constant specific radioactivity, the threshold value for artifact generation decreased with increasing diameter of the syringe. 3) Aside from the radioactivity and the diameter of the syringe, stronger artifact was generated with larger difference in radioactivity between the syringe and the background. For the purpose of excluding the artifact, the highest count of myocardium (Mmax) among the raw data of 72 directions was examined, and reconstruction of image was performed by treating all the values above 110% of Mmax (110% Mmax) as 110% Mmax. Then, exclusion of the artifact was successfully achieved in every case of artifact. In the present examination, it was shown that the streak artifact was affected by the original radioactivity, diameter and difference in radioactivity from the background value. The method developed in the present study enables us to exclude the artifact, and the usefulness of this method in clinical application was suggested.

No. 1401

DOES BODY HABITUS IMPACT STANDARDIZED ATTENUATION CORRECTION RECONSTRUCTION: A CORRELATION WITH CARDIAC CATHETERIZATION

MP White, A Russell, DM Cross, AW Ahlberg, MG Levine, AT Fossati, GV Heller. Hartford Hospital, University of Connecticut, Hartford, CT.

Standardized iterative reconstruction (IR) parameters are used for processing attenuation correction (AC) studies without regard for variations in patient (pts) size. Therefore, the purpose of this study was to determine if pts body

habitus has an impact on standardized AC reconstruction. Forty-six patients referred to the nuclear cardiology laboratory for SPECT myocardial perfusion imaging (MPI) were injected with Tc-99m Sestamibi at rest and peak stress and classified in three groups (Group I: 40-89 kg, Group II: 90-121 kg, or Group III: 122+ kg). Simultaneous transmission-emission images were acquired on an ADAC Vertex dual-head system with Gd-153 scanning line sources. Each data set was processed with AC, using the recommended twelve iterations and without AC. All studies were interpreted blinded with and without AC using a seventeen segment scoring model and compared to cardiac catheterization data.

	Group I		Group II		Group III	
	no AC	AC	no AC	AC	no AC	AC
Sens. %	61	35	66	66	73	64
Spec. %	69	63	62	78	86	71
+PV %	74	57	58	70	89	78

Results: Standardized iterative reconstruction resulted in increased specificity and positive predictive value for patients of average size. However, reduced sensitivity, specificity and positive predictive value were observed in patients with above and below average body habitus when attenuation correction was used.

Conclusion: Patient body habitus affects the sensitivity and specificity of standardized attenuation correction reconstruction.

No. 1402

F-18 Scatter Confounds Estimation of Tc-99m Defect Size in Simultaneous Dual Isotope F-18/Tc-99m SPECT Imaging: Phantom Evaluation
 P. DeMan, J. Baron, I. G. Zubal, F. J. Th. Wackers, A. J. Sinusas. Yale University, New Haven, CT.

Simultaneous dual isotope F-18 fluorodeoxyglucose /Tc-99m SPECT imaging is used to evaluate cardiac metabolism and perfusion. Downscatter from 511 keV F-18 emissions into Tc-99m 140 keV window potentially confounds the size of Tc-99m perfusion defects. A phantom study was performed to quantitatively evaluate changes in Tc-99m defect size with varying Tc-99m/F-18 activity ratios. A Data Spectrum cardiac phantom was imaged using a single head gamma camera, fitted with a ultra high energy collimator (Park Medical Inc.). Two transmural inserts (1.5x2cm) were placed in the central anterior (ANT) and inferior (INF) walls of the phantom. The myocardial space (but not the inserts) was filled with Tc-99m (12 µCi/ml) to create ANT and INF defects. In addition, both inserts and myocardial space were filled with F-18 (14 µCi/ml) to simulate homogeneous metabolic activity thus, mimicking a perfusion/metabolism mismatch. Serial Tc-99m SPECT images were acquired (360°, 64 projections, 10% window) every 2 hr. over a 6 hr. period. Acquisition time was adjusted to keep Tc-99m counts per projection constant. The more rapid decay of F-18 allowed assessment of Tc-99m/F-18 activity ratios ranging from 1.17 to 0.15. A control phantom (CTRL) with Tc-99m (12 µCi/ml) and no F-18 was acquired to provide a standard for uncontaminated defect sizes. Tc-99m images were reconstructed and quantified using circumferential count profiles. The effect of varying F-18

Ratios	1.17	0.58	0.29	0.15	CTRL
ANT	27.2*	25.4*	25.2	23.1	18.2
INF	30.0*	28.0*	24.1	24.6	23.2

* p<0.05 vs. CTRL.

downscatter on Tc-99m defect size was assessed by quantitation of ANT and INF defect nadirs (% of normal)(see table). ANT and INF defect nadirs were significantly underestimated, relative to CTRL, in the presence of high F-18 ratios (1.17 and 0.58). However, when F-18 activity was less, there was no significant effect on defect nadir. Therefore, with perfusion/metabolism mismatch in simultaneous dual F-18/Tc-99m imaging, high relative F-18 concentrations will contribute scatter into the Tc-99m window which may confound Tc-99m defect size estimations.

No. 1410

EFFICIENT USE OF INTEGRATED CAMERA COMPUTER SYSTEMS TO MEET THE NEEDS OF A CHANGING HEALTH CARE ENVIRONMENT. M.A. Schmitt, J.L. Frye, W.R. Watson, and L.M. Willey, Barnes-Jewish Hospital, St. Louis, MO.

In this climate of increasing work load and decreasing budgets how do we, as nuclear medicine technologists maintain timely, quality service? With hospitals trying to contain cost, the health care industry is besieged with mergers, consolidation, and a push for customer satisfaction. This means the nuclear medicine department must be thorough, efficient, and do more with less.

In our department, a series of mergers left us with fewer technologists, more areas in the hospital to cover, and more exams to perform. One way we found to compensate was to take full advantage of the ADAC integrated camera and computer systems we had. The problem we faced was that each of our eight integrated ADAC systems had replaced an analog camera. Each analog camera relied on a technique chart for

protocols. The technique chart was the technologist cheat sheet. It contained not only film intensity settings, but also vital information such as acquisition parameters. With a technique chart in each room, the written procedure manual was rarely consulted. The transfer from analog to digital was not well planned, and protocols were created as needed. Cameras performing the same study had protocols created by different people. Consequently, there was no consistency between individual camera protocols and therefore little consistency in the way procedures were performed.

The first step in creating consistency was to survey all the acquisition protocols, the cameras primary use, and the existing written procedure manual. A series of two letter codes was created and standardized for all the cameras. The name, order, and structure of the protocols were as similar as possible for every camera, so that only slight variations existed.

Second, any protocols that were redundant or not applicable to a specific camera were deleted. Variations, such as flood corrections, scan speeds for whole body procedures, and framing rates for dynamic acquisition were identified. A list of these differences was submitted to the physicians and physicists for a consensus. Any new changes made to an existing protocol are made to all cameras with a note of the date and name of the physician who requested the change. Backups are done monthly and a hard copy of each cameras protocols is kept as reference.

A direct result of these changes has been seen in our department. A technologist can quickly set up for a procedure using the two letter code, and be assured that the camera protocols will follow the written procedure manual created by the physicians. This maximizes camera throughput while minimizing technologist mistakes, thus making the department more able to adapt to changing health care needs.

No. 1411

CLINICAL POSITRON EMISSION TOMOGRAPHY OF BRAIN BY ORAL ADMINISTRATION OF [F-18]FLUORODEOXYGLUCOSE.
 K.L. Chou, H.M. Lin, R.S. Liu, C.P. Chang, L.C. Wu, and S.H. Yeh. Taipei Veterans General Hospital, National PET/Cyclotron Center, and National Yang-Ming University School of Medicine, Taipei, Taiwan.

Traditional positron emission tomography (PET) of cerebral metabolism is carried out by intravenous injection of [F-18]fluorodeoxyglucose (FDG). However, in small baby or in certain patients with chronic illness the venous puncture is sometimes too difficult to carry out a successful injection of the tracers. To overcome this problem, we conducted a study to assess the feasibility of PET imaging of cerebral glucose metabolism by oral administration of FDG.

Two normal adult volunteers were studied. The subjects were asked NPO at least 6 hrs prior to the test. Pre-test serum glucose level was checked and was within normal limits. PET measurements were obtained with a SCANDITRONIX 4096 15WB whole body scanner. After recording a 5-minute transmission scan, a 10 mCi (370 MBq) of FDG was given orally. A 120-minute emission was obtained immediately after oral administration of FDG. Arterial blood was collected to measure plasma radioactivity. Metabolic images were obtained after image reconstruction by using a standard procedure. The subjects repeated the PET study on the next day. All procedures were the same except for intravenous injection of FDG instead of oral administration. The plasma time-radioactivity curves of the two methods were compared. The quality of PET images obtained by using two methods were also compared visually. The plasma radioactivity reached the peak at 5 min after intravenous injection of FDG. The peak activity of plasma FDG was at 45 min by using oral administration. The best PET images of FDG by oral administration were obtained from 75 to 105 min, while the best PET images of FDG by intravenous injection were taken from 45 to 75 min. The total counts of each transaxial slice obtained from the oral method were approximately half of that from the intravenous method. However, the quality of the PET images from each method was the same for visual interpretation.

In conclusion, oral administration of FDG is an alternative method to intravenous injection in case of difficult intravenous injection and when only qualitative interpretation of the images is required.

No. 1412

TRANSMISSION-EMISSION SPECT SYSTEM QUALITY CONTROL
 A.J. Harris, RJ Ackermann, AV Paberz, EP Ficaró. University of Michigan Medical Center, Ann Arbor, MI.

Extensive protocols have been developed to measure performance standards of SPECT imaging systems. Transmission-emission SPECT systems require additional quality assurance measurements. In order to provide optimal clinical images, we devised a protocol that measures transmission resolution, uniformity of reconstructed attenuation maps and attenuation corrected (AC) emission images for transmission-emission tomographic systems.

For this procedure we utilized a 20cm diameter uniform cylindrical phantom filled with water and 185 MBq Tc-99m. A cold rod insert was attached to the bottom of the tank on the outside in air. The phantom was positioned on the head holder of a PRISM XP3000 system equipped with a source holder for transmission tomography. Transmission projection data was acquired with a fanbeam collimator($f_c = 65\text{cm}$) using a 5.6 GBq Am-241 transmission line source. Emission projections were acquired with LEHRP collimators attached to the other detectors. Projection data was acquired simultaneously in 128x128 matrices (3.56mm bin size) over 360° in 120 steps for a total acquisition time of 24 min. A blank transmission scan was acquired for 30

minutes (120M counts) with a 0.5mm Sn attenuator to minimize deadtime effects. Projection acquisition time provided 230K and 450K events in the transmission and emission sinograms for a slice through the cylinder. Emission-to-transmission crosstalk contamination was removed prior to reconstruction. Attenuation maps were reconstructed from the crosstalk corrected transmission data using filter-backprojection. AC emission images were reconstructed using an iterative statistical algorithm.

The reconstructed attenuation map of the cold rods demonstrated a resolution of 6.4 mm. The reconstructed attenuation maps of the uniform cylinder had a mean value of 0.204/cm (expected 0.206/cm for Am-241 photons) with an integral uniformity of 12%. The reconstructed emission image demonstrated integral uniformity of 16%. Simulated errors in crosstalk correction were most evident in the uniformity of the cylinder attenuation maps. Small simulated errors in source-collimator alignment were most noticeable by artifacts (elongation, hot/cold spots) in the cold rod maps.

Based on these results, we believe this protocol provides a reliable method of quality control for transmission-emission SPECT systems in the clinical setting. For other acquisition geometries and transmission sources, the acquisition time can be modified to achieve comparable sinogram event rates.

Session 202

Instrumentation and Data Analysis

2:15-3:45 p.m.

Room: 205

No. 1413

TECHNICAL CONSIDERATIONS IN THE ACQUISITION AND PROCESSING OF INDIUM-111 CAPROMAB PENDETIDE IMAGES IN PROSTATE CANCER PATIENTS. B.S. Williams, J. Fry, R.A. Lamatrice, G.H. Hinkle and J.O. Olsen. The Ohio State University Medical Center, Columbus, OH.

Indium-111 capromab pendetide (In-CP) imaging has proven to be a highly sensitive and specific procedure for evaluation of patients with biopsy-proven prostate cancer who are at high-risk for pelvic lymph node metastases. This investigation looked at the technical factors involved in the assurance of high quality images which are critical in the evaluation of disease spread from the primary tumor site.

Eighty-eight patients were infused with 4-6 mCi (148-222 MBq) In-CP and evaluated for this study. Patient preparation included bowel evacuation prior to imaging utilizing citrate of magnesia (10 oz), 4 bisacodyl tablets (5mg), 3 packets of psyllium fiber (Metamucil) and a Fleets enema. Catheterization of the urinary bladder was performed as needed. Whole body acquisitions were collected at 7.87 cm/sec. All planar images were acquired in a 256x256 matrix for 10 minutes. Two different parameters were employed for SPECT imaging. Fifty-six patients (63.6%) were acquired in a 64x64 matrix and 32 patients (36.4%) were acquired in a 128x128 matrix. Time per step ranged from 45 to 65 minutes per step. All SPECT studies were reconstructed using a 360 degree filtered back projection RAMP filter/Low Pass 3-D post filter.

Results indicate a larger matrix and longer acquisitions are needed to render high quality images. SPECT images acquired in a 128x128 matrix at 65 sec/step on Day 4, 5 or 6 post-infusion produced the best results. The best resolution was found using a Low Pass 3-D post filter with an order 4-10 and a cut-off of 0.23 to 0.32. In patients with a large amount of disease (high count rate studies) a Weiner or Metz filter was found to be superior.

No. 1414

A VERSATILE AND EFFECTIVE EPILEPSY DOSAGE MANAGEMENT SYSTEM. D.V. Porter, T.J. Herold, J.C. Hung, and B.P. Mullan. Mayo Clinic, Rochester, MN.

Administering radiopharmaceuticals to epilepsy patients for the purpose of imaging a localized area of the brain poses several problems. Effective seizure foci localization requires that the patient is injected with the radioactive drug while the seizure is in progress. Because an episode may last, at most, 20 min, there is generally not enough time for the nuclear medicine technologist to prepare the radiopharmaceutical and transport it to the patient in the epilepsy unit for injection. Therefore, the radiopharmaceutical must be prepared beforehand and located near the patient for immediate injection as the patient experiences seizure. In our institution, two doses of Tc-99m-bicisate (Tc-99m-ECD) are drawn and transported to the epilepsy unit for each 8-hr interval in

which a patient will be monitored for seizure. Syringe 1 is used during the first 4-hr interval, with Syringe 2 replacing it for the second 4 hr of the interval. These syringes are decay corrected to obtain the desired amount of activity during the specified time interval, and are measured in a dose calibrator prior to being dispatched to the epilepsy unit. A computer-managed spread sheet program (Epilepsy Dosage Management System) has been developed to aid in calibration of these dosages. The activity, time of measurement in the dose calibrator, and patient weight are entered onto the spread sheet. After injection of the radiopharmaceutical, the time of injection, and syringe number are entered. The spread sheet calculates the decay-corrected activity at the time of injection. The advantages of using the spread sheet are: (1) it will calculate an adjusted dosage based on patient weight for patients < 18 year of age; (2) it allows for easy calculation of patient dosages which are injected at a remote location; and (3) the time interval of radiopharmaceutical useful life, the dosage amounts of the syringes, and the number of syringes used during a given time interval can be made user definable. In conclusion, our Epilepsy Dosage Management System not only allows flexible options to meet different operation needs, it also provides an effective and accurate way to calculate and maintain epilepsy patient doses.

No. 1415

QUANTITATIVE ANGER CAMERA IMAGING WITH Lu-177. D.G. Elliott, D.J. Macey, R.F. Meredith, A.F. LoBuglio. University of Alabama at Birmingham, AL.

Lu-177 is a commercially available rare earth radionuclide that potentially offers advantages over I-131 for radioimmunotherapy. A large number of low energy photons emitted at 113(6.6%) and 208(11%) Kev permit superior Anger camera imaging with a medium or low energy collimator, while the beta particles emitted have an energy $E_{max} = 497$ Kev with a range in tissue comparable to I-131. The objective of this study was to develop a simple scatter subtraction method using the events acquired in multiple energy windows for quantitative Anger camera imaging. Anger camera images were acquired simultaneously in 2 photopeak(113 and 208 Kev) and 2 scatter windows with a medium energy collimator fitted to a large field of view camera. A low energy scatter window was placed below the 113 Kev peak and an upper energy scatter window between the 113 and 208 Kev peaks. A simple subtraction algorithm was employed to remove the large fraction of spilldown events that are included in the 113 Kev images from the 208 Kev photons. The scatter subtraction procedure employs 3 steps with the same scatter multiplier of 0.5 to normalize the scatter window events to scatter events included in the 2 photopeak images. The method was tested by acquiring images of an abdominal phantom fitted with a liver and spleen volumes. Scatter subtraction with this quadruple energy approach was found to improve image contrast and definition of organ boundaries for regions of interest and level background around sources. Without scatter subtraction the activity in the liver and spleen was overestimated by about 28 %; after scatter subtraction, the activity in the liver and spleen was estimated to better than 10%. This scatter subtraction approach will improve the accuracy of radiation absorbed dose estimates for radioimmunotherapy with Lu-177 CC49 for ovarian cancer patients and the method can be extended to other multiple photon emitting radionuclides.

No. 1416

CLINICAL UTILITY OF 3-DIMENSIONAL IMAGE DISPLAY IN NUCLEAR MEDICINE. K.F. Smith, I.S. Seo, C.J. Homs, Y.I. Shonibi, J.G. McBride, P. Sze, and W.M. Sy. The Brooklyn Hospital Center/New York University School of Medicine, Brooklyn, NY.

Three-dimensional (3D) display of SPECT is increasingly used for the assessment of a variety of pathological conditions. Whether surface rendered (SR) or volume rendered (VR) display techniques are used, the viewer can frequently obtain a better evaluation of the size of an abnormality, as well as the relationship of the abnormality to the entire system under study.

We have successfully used both cinematic and stationary display of 3D SR SPECT to evaluate a variety of clinical situations. In gated myocardial perfusion SPECT, the viewers can observe regional alterations in myocardial wall thickening with greater clarity than when using cinematic SPECT slices alone. In the evaluation of ventricular aneurysm in gated blood pool imaging, 3D SR SPECT allows global assessment of dyskinesia effectively. 3D SR SPECT has also been used for qualitative evaluation of predictive post-surgical residual lung function in patients referred for lung surgery. VR techniques have been used in a variety of situations including assessment and localization of lesions in bone and renal SPECT.

A potential pitfall in the display of SR images is improper use of threshold values, which can drastically alter the appearance of the rendered image. Prior to calculating the rendered image, we display the transaxial slices and alter the window and baseline settings until optimal display is achieved. The threshold value obtained in this manner is then used for the calculation of SR images. Using this display approach has helped eliminate artifacts from 3D images. Requiring no modifications to the acquisition and processing of the SPECT studies, 3D display is a useful adjunct in the evaluation of a variety of pathological conditions.

No. 1417

COMPARISON OF ANALYTIC AND MEASURED ATTENUATION CORRECTION METHODS IN PET BRAIN IMAGING. D.L. Gibbons, B.A. Harkness, S. Martin, F.H. Fahey, J.W. Keyes, Jr. Bowman Gray School of Medicine, Winston-Salem, N.C.

Although accurate correction for attenuation is important in PET brain scans, many patients find it difficult to remain motionless for the duration of the transmission scan. Sedation prior to injection of the FDG will depress pharmacologically the glucose metabolic rate (GMR). An analytic attenuation correction method that most accurately duplicates GMR values obtained using transmission measured attenuation correction was desired. Three methods of boundary determination (individual ellipse, automatic boundary, and individual hand-drawn ROI) for an analytic attenuation correction were applied to previously acquired data on 5 patients that also had measured attenuation correction. The analytic and measured attenuation correction were compared using the average GMR values in regions drawn on the whole brain, right thalamus, and inferior frontal lobe. The results were:

Region	Meas	Ellipse	Auto	Hand-drawn
Whole Brain	7.82	7.57	7.00	6.02
Rt. Thal.	10.8	9.72	9.09	7.91
Inf. Front.	7.71	7.88	7.47	6.39

A paired t-test was performed comparing the measured GMR to each analytic GMR. The individual ellipse method yielded averages closest to the measured in all regions. All values obtained with the analytic attenuation correction were significantly different than those obtained with measured attenuation correction ($p > 0.05$).

No. 1418

A COMPARISON OF METHODS FOR COREGISTRATION OF SPECT CEREBRAL BLOOD FLOW IMAGES OVERLAYED ON MRI FOR LOCALIZATION OF EPILEPTIC SEIZURE FOCI. J. MacMullan, I.G. Zubal, S.S. Spencer, G. Wisniewski, M. Spanaki, B. Rossi, E.O. Smith, J. Seibyl, Yale University, New Haven, CT.

Methods of image processing which utilize coregistered SPECT brain images with MRI to aid in the clinical localization of epileptic seizure foci are compared. Patients are injected with 20mCi of Tc-99m-HMPAO ictally and interictally, and cerebral blood flow images are acquired. The ictal and interictal SPECT scans and the MRI scans are then transferred from the hospital clinical areas to the NeuroSPECT Center computer processing lab in the university. The transfers of these data sets are accomplished using file transfer protocol software over the network. The raw data are processed and then one of two processing methods is employed. Data is transferred to a VAX/VMS unit where the images are processed; each ictal scan is registered to the same patient's interictal scan using labor intensive surface contour mapping techniques. Once registration is completed, the 3D data are processed through a computer program which normalizes the data to total brain counts, performs subtraction of the SPECT images, and computes functional difference images as well as percent-change images. The same data set is transferred to a SUN SPARCstation 20 where commercially available software, Analyze and AIR, coregisters the images and creates difference images using a voxel to voxel comparison in approximately one-sixth of the time. Data is then transferred to a PC workstation where regions of interest are drawn around areas of increased perfusion differences to give a quantitative measure of blood flow changes during seizure. A comparison of quantitated outcomes for the two methods using five patient data sets showed less than five percent difference between the methods of analysis.

Processing methods on different computer platforms utilizing readily available software provide equivalent data, suggesting the clinical viability of these algorithms.

Tuesday, June 3, 1997

Session 203

Pulmonary, Bone/Joint, Renal and Neuroscience

8:00-9:30 a.m.

Room: 205

No. 1420

VENTILATION-PERFUSION LUNG SCANS USING SPECT: A SIMPLE AND RAPID TECHNIQUE. C.E. Casey, L.E. Rickabaugh, and D.W. Seldin. Lahey Hitchcock Medical Center, Burlington, MA.

SPECT acquisition of ventilation-perfusion lung scans is a fast, easy scanning method that has several advantages over planar imaging. Over the past two years we have performed over 500 SPECT lung scans. Ventilation imaging using approximately 1 mCi (37 MBq) of Tc-99m DTPA aerosol is followed by perfusion images using an average of 6 mCi (222 MBq) of Tc-99m MAA. The imaging protocols are the same for both ventilation and perfusion scans. The studies are performed on a dual-head SPECT camera using ultra-high resolution collimators. Continuous acquisition of 3° steps over 360° is performed in 10 minutes (10 sec/step). A 64 x 64 image size is used. Studies are reconstructed using a Ramp filter followed by a Wiener postfilter. Transaxial, coronal, and sagittal images are generated, as well as eight raytrace images at 45° intervals which simulate conventional planar images. The total imaging time is twenty minutes, as compared to planar imaging time of 32 minutes (four sets of paired images at 4 minutes each for both ventilation and perfusion) using a dual-head camera. There is no time lost in repositioning the patient, who lies supine for the entire study. The ability to leave the patient in one position is particularly useful for seriously ill patients.

Images are interpreted either on the computer display or from films of the paired ventilation-perfusion views. Acceptance by nuclear medicine physicians, radiology staff and residents, and clinical staff has been very good. The presence of the raytrace images makes it easier to learn to interpret the SPECT slices, and to compare new SPECT studies to prior planar exams.

In conclusion, our experience has been that SPECT ventilation-perfusion imaging is faster and easier than planar imaging for both the technologist and for the patient, and is therefore a cost effective method.

No. 1421

TECHNICAL ASPECTS OF VENTILATION IMAGING WITH Tc-99m PERTECHNEGAS. J.F. Wieseler, D.R. Mack, and G.A. Wiseman. Mayo Clinic, Rochester, MN.

Tc-99m pertechnegas is a new radiopharmaceutical which is used for ventilation imaging studies in patients with possible pulmonary emboli. This ventilation imaging agent has been used in our Nuclear Medicine Department in a research study. Tc-99m pertechnegas is a radiolabeled gas produced by heating Tc-99m pertechnetate in a carbon crucible in an atmosphere of argon plus 2-5% oxygen. This radiopharmaceutical agent distributes throughout the lungs when administered by inhalation. Planar gamma camera images were then obtained in eight projections using a dual headed gamma camera. There was less central airway deposition and in patients with obstructive lung disease and better imaging of the lung margins with Tc-99m pertechnegas than previously seen with aerosolized Tc-99m DTPA. The use of Tc-99m pertechnegas ventilation imaging has the advantage over Xe-133 of being able to obtain similar projections as those acquired on perfusion imaging with Tc-99m macroaggregated albumin in determining lung areas of ventilation-perfusion mismatch. Additionally the Tc-99m pertechnegas has better imaging properties than Xe-133 including less attenuation from the lung, soft tissue and chest wall. We imaged 90 patients who received both the Xe-133 and Tc-99m pertechnegas on separate ventilation studies. The ease of administration and imaging of the Tc-99m pertechnegas was evaluated along with the Xe-133 ventilation studies by the technologist. Comfort of administration for the Xe-133 and Tc-99m pertechnegas studies was surveyed by a patient

questionnaire. In general patients tolerated both ventilation studies well. The production of the Tc-99m pertechnegas was quickly learned by the technologists, was reproducible, was always available and its use may eliminate the need to have Xe-133 available for ventilation imaging.

No. 1430

UNIPLANAR FAN BEAM COLLIMATORS IN SKELETAL IMAGING
 D.S.Thakrar, J.B.Cwikla, J.R.Buscombe, A.J.W.Hilson. Royal Free Hospital and School of Medicine, London UK

A recent development in improving the sensitivity of SPECT acquisitions on a dual headed gamma camera (Picker XP2000) has been the arrival of unipolar fan beam (cardiofan) collimators. These collimators have an inbuilt zoom factor of 1.66x and the organ of interest must be placed in the centre of the orbit of rotation. These collimators have been designed for use in imaging of the heart, but the combination of improved sensitivity and intergral zoom means they can be applied to well defined areas of the skeleton.

We have had experience in using these collimators in 40 bone scintigrams including 9 SPECT acquisitions of the feet, 2 knees, 1 hips and the remainder in the lumbar and thoracic spine. Using a standard activity of 15-20mCi it was possible to obtain good images with only a 10 minute acquisition. This was useful when multiple sites had SPECT imaging in the same patient such as performing thoracic and lumbar spine images in the same patient. The resolution of the study was superior to that obtained using parallel hole collimators particularly when looking at the feet. In the lumbar spine it was possible to differentiate the cortex of the vertebrae from the spongy bone, potentially useful in differentiating metastases from benign disease. However these collimators could not image the knees in one immobile obese patient and the hips and it was impossible to keep both knees/hips in the field of view. This pilot study suggests that unipolar fanbeam collimators designed for SPECT work in one organ can be readily transferred to another organ and enhance SPECT imaging, at least of the spine and feet.

No. 1440

REPRODUCIBILITY OF THE Tc-99m MAG3 CLEARANCE BASED ON PROBE, SINGLE SAMPLE, MULTIPLE SAMPLE AND CAMERA BASED TECHNIQUES.
 Russell Folks, Patti Corrigan, and Andrew Taylor, Department of Radiology, Emory University School of Medicine, Atlanta, GA

We have previously shown that, for a single injection, two compartment model, the rate of excretion of Tc-99m MAG3 from compartment 1 (k10), determined by an externally positioned probe, could potentially be used as an index for MAG3 clearance (clr). The present study was undertaken to determine the reproducibility of this technique.

10 asymptomatic volunteers, mean age 47.0 (29-75) entered the protocol and were studied twice, two days apart. Each volunteer received 185-222 MBq (5-6 mCi) Tc-99m MAG3 for each study. A probe (Captus 2000, Capintec, Inc.) was positioned over the arm contralateral to the injection site, and counts were obtained dynamically for 60 minutes. Seven plasma samples were obtained from each volunteer at 5,10,15,20,30,43 and 60 minutes post injection and used to calculate a multiple sample (MS) clr. The probe k10 was determined from a biexponential fit to the probe MAG3 disappearance curve, and was compared to the k10 derived from the plasma samples. Simultaneously, gamma camera images were acquired; single sample clr (SS) and camera based clr (CAM) were calculated using the QuantEM™ software (J Nucl Med 1995; 36:1689). One patient prior to the second study had a lipemic plasma and was excluded from the data analysis. Results for study 1 vs 2:

	probe k10	plasma k10	MS clr	SS clr	CAM clr
correlation (r)	0.84	0.66	0.84	0.86	0.90

Preliminary data suggest that a MAG3 k10, as measured by an external probe, may provide a reproducible index of renal clearance. The k10 measurement has the additional advantages of eliminating the need for a standard or blood sampling.

No. 1441

USE OF AN EXTERNAL PROBE TO MONITOR THE MAG3 CLEARANCE WITHOUT BLOOD SAMPLING.

Patti Corrigan, Russell Folks, and Andrew Taylor, Department of Radiology, Emory University School of Medicine, Atlanta, GA

The clearance of Tc-99m MAG3 can be calculated using a single injection, two compartment model. The rate of excretion (k10) from compartment 1 is proportional to the clearance and can be calculated from a biexponential fit to the plasma disappearance curve; it is independent of dose injected. The plasma disappearance curve is usually obtained from multiple plasma samples (MS). The purpose of this study was to determine if the rate of excretion determined from an externally positioned probe would be equivalent to or proportional to the MS clearance or the rate constant determined from MS.

24 subjects were studied: 10 asymptomatic volunteers, mean age 47.0 (29-75) were studied twice, two days apart. 6 patients, mean age 57.5 (20-73) were also studied. Volunteers received 185-222 MBq (5-6 mCi) Tc-99m MAG3 for each study, while patients received 161-362 MBq (4.4-10 mCi). 7 plasma samples obtained from each subject at 5, 10, 15, 20, 30, 43 and 60 minutes post injection and used to calculate a multiple sample (MS) clr. A probe (Captus 2000, Capintec, Inc.) was positioned over the arm contralateral to the injection site, and counts were obtained dynamically at 1 minute intervals for 60 minutes post injection, and plotted to obtain a probe plasma disappearance curve. The probe k10 was determined from a biexponential fit to this curve, and was compared to the MS k10 and the MS clearance. One volunteer had a lipemic plasma and was excluded from the data analysis.

There was good correlation between the probe k10 and the k10 determined from the MS plasma disappearance curve (r = 0.86) as well as good correlation between the probe k10 and the MS clearance (r = 0.76). A probe k10 provides a noninvasive measurement which is proportional to the MAG3 clearance and potentially could be used to monitor sequential function.

No. 1450

ASSESSMENT OF SPLIT RENAL FUNCTION ON A DUAL DETECTOR CAMERA USING GEOMETRIC AVERAGING OF OPPOSING VIEWS. Y.L. Shonubi, K.F. Smith, I.S. Seo, C.J. Homs, P.Sze, J.G.McBride, and W.M. Sy. The Brooklyn Hospital Center/New York University School of Medicine, Brooklyn, NY.

Split renal function (SRF) is routinely calculated from the posterior projection. However, relying on the posterior view alone might yield misleading results in patients with ptotic, ectopic, or hydronephrotic kidney and other conditions in which one or both kidneys are anteriorly displaced. This investigation was undertaken to determine if there is any significant statistical discrepancy between SRF calculated from the posterior projection only and geometric averaging of both anterior and posterior projections.

Between July 1 and December 31, 1996, 72 patients were referred to our laboratory for dynamic renal scans. Twenty-eight patients were imaged using a dual detector camera. Immediately following injection of 185 to 555 MBq of either Tc-99m Mag3 or DTPA, dynamic images were obtained for 3 sec/image for the first minute, followed by 20 sec/image for 30 to 60 minutes. The images were acquired using a matrix size of 128 x 128 in word mode. Upon completion of acquisition, regions of interest were drawn over each kidney in both anterior and posterior projections and background corrected renograms were generated. SRF was first calculated from the posterior projection alone. An additional calculation was then obtained from the anterior projection and geometrically averaged with the data from the posterior projection.

Twelve of 28 (42.9%) patients demonstrated a significant discrepancy (mean increase of 7.5% of the abnormal kidney, P < 0.02): 3 patients with ptotic kidneys, 1 with ectopic kidney, 1 with a large mass lesion in one kidney and 7 with unilateral hydronephrosis. Compatible SRF data were noted in 2 patients with bilateral hydronephrosis, in 5 patients with chronic renal failure, and in 9 patients with normal functioning kidneys. Routine use of a dual detector camera is strongly recommended for renal scans to eliminate potentially erroneous SRF calculations in cases of abnormally displaced kidneys.

Session 204
Neuroscience

9:45-11:15 a.m.

Room: 205

No. 1451

CLINICAL EVALUATION OF PARKINSONS DISEASE BY SPECT WITH I-123 ALTROPANE. S.A. Barrow, J.W. Babich, B.K. Madras, A.J. Fischman. Massachusetts General Hospital, Boston, MA.

Parkinson's disease (PD) is a progressive neurodegenerative disease that is associated with depletion of pre-synaptic dopamine (DA) transporter sites in the striatum. Thus, radioligands that bind to these sites are useful for monitoring disease progression. In this investigation, we used [I-123] 2β-carbomethoxy-3β-(4-fluorophenyl)-N-(1-iodopropyl-en-3-yl)nortropine (I-123-Altropine) in SPECT studies of healthy volunteers and patients with PD.

Seven healthy volunteers (5 males and 2 females) and 8 male PD patients were studied. After thyroid blockade with SSKI, each subject was injected with 5-10 mCi of I-123 Altropine and dynamic SPECT/arterial blood sampling was performed for 1.5-2 hrs using a dual headed SPECT camera. The images were reconstructed with a filtered back projection algorithm (Butterworth filter). Striatal (Str) binding potential (BP, B_{max} / K_D) was calculated from Str TAC's and metabolite corrected arterial input functions using occipital cortex as reference.

In the healthy volunteers, Altropine accumulated rapidly in the striatum and excellent quality images were obtained within 1 hr after injection. The selectivity of the tracer was supported by lack of accumulation in serotonin rich regions of the brain. Average BP was 1.77±0.18. In the patients with PD, striatal accumulation was significantly reduced. This reduction was most pronounced in the posterior putamen and the caudate nuclei were relatively spared. In the PD patients, BP was reduced to 0.92 ± 0.05 (p<0.001).

These results establish that I-123 Altropine has the favorable characteristics of: 1. High accumulation in normal striatum. 2. Reduced accumulation in striatum of PD patients. 3. Selectivity for dopamine vs. serotonin binding sites. 4. Pharmacokinetics that are well matched to the physical half-life of I-123. In the future, this radiopharmaceutical could be of great value in the diagnosis and therapeutic monitoring of patients with PD and other movement disorders.

No. 1452

Quantification of rCBF During Cerebrovascular Stress and Mental Activation by a Triple-Head SPECT Camera Using Xe-133.

H. G. Liu, E. C. San Pedro, J. M. Mountz, G. Deutsch. University of Alabama at Birmingham Medical Center, Birmingham, AL

Introduction: Xenon clearance rCBF SPECT provides a cost effective method to obtain quantitative, repeatable whole brain scans that are very sensitive to physiological stress and mental activation. This report presents the results of studies on 15 subjects.

Methods: Ten patients with carotid stenosis were studied during rest and Diamox induced stress using standard Tc-99m HMPAO SPECT and a new Xe-133 SPECT method on the Picker PRISM 3000-XP tomograph. For Xe SPECT, high sensitivity collimators, a Xe-133 inhalation unit, and a CdTe probe were integrated with gantry electronics to perform complete scans every 10 sec for 6 min with a spatial resolution of 12-13mm (FWHM). Dynamic images were acquired at 3 degree intervals into a 64 x 64 matrix. Each detector head acquires 40 projection images at a radius of 13cm over 120 degree circular orbit. Subjects inhaled Xe-133 gas in an air mixture (740MBq/L) during the first minute of the scan. The input function was monitored with a scintillation probe placed over the lungs and stored time-locked with the projection data. A modified version of the original Kanno-Lassen algorithm was used for calculating rCBF from SPECT data and final images were generated representing rCBF quantitatively in ml/100g/min. Data analysis was performed using the computer automated circumferential ROI system developed in our lab. For the stress studies 1.0 gram I.V. Diamox was injected 15 minutes before the Xe SPECT scan. For the mental activation studies, five subjects started the task 1 minute prior to Xe inhalation and continued for the scan duration.

Results: CVD Stress: Xe SPECT showed a greater asymmetry in flow both at rest and during Diamox stress. Xe SPECT showed a mean rCBF asymmetry during Diamox of 22.8±12.4%. HMPAO SPECT showed a mean asymmetry of 9.2±6.6% post Diamox. Mental Activation: Highly significant changes in flow distribution and absolute flow occurred during the task condition. The rotation task caused significant asymmetric increases in cerebral hemispheric flow: right/left increased by 4.2 ml/100g/min.

Conclusion: This study illustrates the sensitivity of a new triple head Xe SPECT system to both cerebrovascular stress and cognitive activity. Xe SPECT showed greater differences than Tc-99m HMPAO SPECT in flow to compromised vascular regions, consistent with clinical and angiographic evidence. It also demonstrated focal right hemisphere activation during a visuo-spatial task.

No. 1453

The clinical use of O-15 water PET for determination of qualitative brain perfusion in the psychiatric population: A viable alternative to brain SPECT imaging? G.P. Leisure, F. Miraldi, J.K. O'Donnell and M. Parsa. University Hospitals of Cleveland. Cleveland, OH.

The use of Tc-99m and I-123 labelled compounds for SPECT imaging of the brain in patients with psychiatric disorders is well-established. However, PET imaging of brain perfusion with O-15 water offers numerous potential advantages over traditional SPECT imaging: (1) superior radiotracer pharmacokinetics; (2) lower radiation absorbed dose; (3) ability to repeat imaging in the same session due to the short half-life of O-15; (4) ability to acquire true measured attenuation; (5) equivalent, or in most cases superior, image resolution compared to SPECT; (6) reduced motion artifact due to shorter acquisition time and hence the ability to better image difficult patients; (7) increased referring department productivity since staff members who must accompany patients spent much less time away from the department; (8) greater scheduling flexibility at our institution; and (9) lower study cost primarily due to the cost-savings advantage of producing O-15 in-house over commercially-supplied SPECT pharmaceuticals. We have successfully performed over 125 qualitative PET brain perfusion studies to date and have found PET to be an efficacious and cost-effective tool in the management of psychiatric patients.

No. 1454

Comparison Between Early (E) and Delayed (D) Tc-99m ECD and HMPAO SPECT Brain Perfusion Imaging (BPI) H.M. Abdel-Dayem, W. Omar*, R. DePaul, E. Abdel-Dayem, J.Q. Luo, S. Naddaf, M.F. Akisik, H. El-Zafrawy, J. Masdeu and R. O'Connell. St. Vincent's Hosp. and Med Center, New York, NY Med Coll, Valhalla, NY, (IAEA/NRCF* fellow)

Two Tc-99m labeled compounds are currently approved for SPECT BPI. 1: Tc-99m, HMPAO and Tc-99m ECD. There is debate regarding in vivo stability of brain uptake of both and optimum imaging time following the IV injection.

We aimed to compare E and D BP SPECT studies by calculating uptake ratios of both, to evaluate the in vivo stability and if there are any changes between E and D imaging. This study included 2 groups, each has 29 pts. Group A injected 20 mCi (740 Mbq) of Tc-99m HMPAO. Group B injected 20 mCi (740 Mbq) of Tc-99m ECD. Group A's E images were taken at 60 min. and D images at 3 hours. Because ECD has a faster blood clearance, Group B's E images were at 30 minutes and D at 2 hours, following IV inj. All pts were imaged on the Triad "Trionix" gamma camera. A total of 120 projections/40 seconds per frame. Same acquisition time was used for E and D images, processed using same manufacturer's recommended protocol. We generated in-house template contained 43 ROI for all the transaxial slices, generated using 4 pixel (14.24mm) thick transverse cuts. This generated 7 transaxial brain slices. We used the cerebellum as our reference maximum uptake.

We generated a curve from all pts demonstrating the changes between uptake along the early (maximum count), delayed (minimal count) and the main changes along the 43 ROI generated per pt. The results for both HMPAO and ECD are as follows:

	HMPAO	ECD
Average E Ratio	0.870	0.845
Average D Ratio	0.857	0.865
Early-Delayed Ratio	0.07	-0.02
Maximum Early-Delayed Ratio	0.493	-0.274
Minimum Early-Delayed Ratio	0.321	-0.273
Avg 1 SD for Early Ratios	0.259	0.320
Avg 1 SD for Delayed Ratios	0.356	0.350
Correlation Coefficient Early vs. Delayed	0.8	0.8

We conclude that from these calculations that both Tc-99m ECD and HMPAO did not show significant variations in uptake ratios between early and delayed imaging.

No. 1455

TECHNICAL ASPECTS OF PERFORMING ICTAL BRAIN IMAGING. W.M. Oswald, J.C. Hung, and B.P. Mullan. Mayo Clinic, Rochester, MN.

Nuclear medicine brain imaging has been found to be useful in the evaluation of patients with epilepsy. Ictal brain imaging has been particularly helpful in this diagnosis. A procedure was developed at our institution that provides a mechanism for performing the ictal brain scan. The preparation of Tc-99m-bicisate (Tc-99m-ECD) is performed in a manner that allows for 2 syringes (740 and 1,665 MBq [20 and 45 mCi]) to be drawn for each patient having an ictal brain scan procedure. These syringes are stored in the epilepsy unit of our hospital, where patients are monitored by EEG technicians around the clock. The EEG technicians have been trained in the administration of radiopharmaceuticals as well as good radiation safety practice. The Tc-99m-ECD is injected by the EEG technician during the onset or immediately after the patient has a seizure (within 4 min). Following the injection, the patient is given a loading dose of anti-epileptic medication to reduce the possibility of seizures during the imaging procedure. SPECT imaging should not commence in the nuclear medicine lab until the patient has been suitably medicated to prevent seizures during the SPECT imaging. Imaging is performed using 128 x 128 byte mode matrix, 10 x 360 degree cycles, 120 views/cycle @ 2 sec/view, no zoom and fan beam collimators. The patient lies supine on the imaging table with their head in a restraint to minimize head motion. Various logistical problems, issues relating to training the EEG technicians, and specific concerns when imaging the patient will be discussed. To date, we have performed 206 ictal brain SPECT studies in our nuclear medicine lab. Preliminary analysis of a sub-set of this group showed seizure localization in ~90% of these cases. The results from these ictal imaging procedures have been very helpful in the management and care of patients with epilepsy.

Session 205

Hematology and Oncology

12:30-2:00 p.m.

Room: 205

No. 1460

EVALUATION OF RADIATION SAFETY MEASURES DURING TREATMENT OF CHILDREN WITH HIGH DOSE I-131-MIBG. WJM van den Broek, WCAM Buijs, FHM Corstens. Department of Nuclear Medicine, University Hospital Nijmegen, The Netherlands.

In 1993 the pediatric oncologists asked us to startup a protocol for high dose I-131-MIBG therapy for children with disseminated neuroblastoma. At that time we had experience with nursing of adult patients with metastasized carcinoma of the thyroid, receiving high doses of sodium-I-131. Most of the children with widespread neuroblastoma obviously need time consuming care. Therefore the effect of various radiation safety measures for patients, parents and staff were evaluated.

Methods: During the past three years 10 young children (1-9 years old) with metastasized neuroblastoma were submitted to the hospital radiation protection isolation facilities for 6 - 10 days per treatment with I-131-MIBG. The administered dose was either 3.7 or 7.4 GBq I-131 per treatment. The individual children underwent 1 - 10 treatments and stayed in the isolation room, according to dutch legislation, till the radiation dose rate at 1 meter distance was below 20 μ Sv/hr. In order to let the children kill time without asking attention of parents and staff, we created a childfriendly isolation room by bringing in toys, TV, VCR, etc. The parents of these children were hospitalized on the same ward and took care of their own child during the isolation. The nurses of the ward provided the medical care. For measurement of the external radiation dose, all persons who went into the isolation unit, were instructed to carry a Thermo Luminiscense Dosimeter (TLD) as well as an Electronic Personal Dose ratemeter (EPD) (Stephen 6000). The EPD gave a friendly audible signal when a dose rate of 150 μ Sv/h was exceeded, indicating: "Make your stay as short as possible".

Results: Before the introduction of EPD the individual doses of the parents ranged from 0.29 - 3.96 mSv per treatment and were highly dependent on the degree of illness and age of the child. After EPD, the mean dose was reduced to 50 %. Nurses and nuclear technologists received doses less than 0.15 mSv per treatment. After the introduction of I-131-MIBG therapy the collective dose of all nurses increased from 2 to 5 mSv/yr. The highest individual dose for the nurses was doubled after starting this therapy protocol, however with 0.72 mSv/year still far below the annual limit for radiologic workers.

In conclusion, participation of parents in children's care reduces the radiation burden to the staff. The external radiation dose of parents can be kept within acceptable limits by guidance of an Electronic Personal Dose rate meter.

No. 1461

99mTc-Sestamibi prone scintimammography: Comparative analysis of multiple window imaging. A.Gagnon, R Taillefer, G. Bavaria, J. Brisebois, C. Benjamin. Hotel-Dieu de Montréal, Canada

Prone scintimammography (SM) with ^{99m}Tc-Sestamibi has been shown to have a complementary role in the evaluation of women suspected of having breast cancer. Various imaging techniques have been proposed using different cushions and/or tables that can produce compton scatter within the ^{99m}Tc window. The purpose of this study was to evaluate the effect on image contrast, uniformity and lesion detection when images are acquired using different energy windows and to determine the optimal energy window to use with SM. Twenty consecutive women referred for SM for the evaluation of a suspected mass were enrolled in the study. Patients were injected with 25.2 +/- 1.9 mCi of 99mTc-Sestamibi in the contra-lateral arm of the suspected lesion or in a pedal vein when bilateral lesions were suspected. Images were initiated within 30 minutes after injection. Image acquisition was performed using an Isocam II dual head gamma camera (Park Medical) with a 128x128 matrix and a zoom of 2. Lateral positions were first acquired using a special cushion with semicircular apertures that allowed breast separation from the torso and included the axilla. The anterior view was acquired using a zoom of 1.14 and included both axilla. Images were acquired with a set of 9 preset windows of 3-6 Kev ranging from 126 to 156 Kev. Windows were combined to produce A) 9% window centered at 140 Kev B) 15% asymmetrical window (135-150Kev) and C) 21% window centered at 140Kev. Count densities were evaluated on the left lateral view and a region of interest was drawn over the breast for the 3 different windows. Qualitative evaluation of the images was performed with two experienced observers judging the contrast, uniformity and lesion detectability.

Results: The average count density over the breast was A) 26K, B) 33k and C) 47k, total count per left lateral view were A) 1.3 x 10⁶ counts, B) 1.6 x 10⁶ counts and C) 2.0 x 10⁶ counts. Percentage of counts coming from the breast was A) 2.2%, B) 2.2% and C) 2.4%. A slight improvement in contrast was seen on images with a 9% window compared with 21% with a slight decrease in uniformity. This was more obvious when the count density was low (< 20k over the breast). No diagnostic differences were noted using the different windows in that small group of patients. The preferred window was 9% when the count density was adequate.

No. 1462

TECHNETIUM (Tc) 99m P829: TECHNICAL CONSIDERATIONS FOR IMAGING NEUROENDOCRINE TUMORS. D.A. Erb, H. A. Nabi, E. Farrell. Department of Nuclear Medicine, State University of New York at Buffalo, Buffalo, NY; Diataide, Inc., Londonderry, NH.

P829 is a Tc99m labeled synthetic peptide currently being evaluated in clinical trials for fast imaging of neuroendocrine tumors. In a phase III trial, twelve patients with known or suspected neuroendocrine tumors were studied. All patients had an Indium (In) 111 Pentetreotide scan either 7-6 days prior or 1-14 days post Tc99m P829 scans.

Patients received approximately 20 mCi (50 ug of peptide) Tc99m P829. Planar images at 1 hr. and 3-6 hrs. were taken for 1 million counts (cts.) each using a high resolution collimator. Images included: head/neck, chest, abdomen and pelvis. SPECT at 3-6 hr. session: for 15-20 sec/stop, in a 360 degree orbit. In-111 pentetreotide planar imaging was performed at 4 hrs. for 300 sec/image. 24 hrs.: planars imaged for 450 seconds, and SPECT for a minimum of 40 sec/stop in a 360 degree orbit.

Tc99m P829 exhibited overall good sensitivity for tumor detection with shorter imaging sessions than In-111 Pentetreotide. Shorter procedure length facilitated faster patient throughput with a favorable dosimetry profile.

	Tc-99m P829	In-111 Pentetreotide
Total imaging time	80 min.	160 min.
Procedure length (start to finish)	6 hrs.	26 hrs.
Whole body radiation dose	1.12 rem/20 mCi	2.61 rem/6 mCi
Target organs	thyroid, kidneys, spleen	spleen, kidneys, bladder wall

This study demonstrated the feasibility of imaging neuroendocrine tumors with Tc-99m P829, with shorter imaging time contributing to patient comfort, in addition to a 50% reduction in whole body radiation dose.

No. 1463

ProstaScint: Technical Considerations. Nancy L. Reed and Michael K. Haseman. Sutter Community Hospitals. Sacramento, CA.

ProstaScint is an intact murine IgG1 Indium-111 labeled monoclonal antibody reactive with prostate specific membrane antigen. This antigen is present in normal prostate tissue, nearly all prostate cancers and in benign prostatic hypertrophy. ProstaScint can detect cancer that has spread to lymph nodes in patients pre-therapy and in those who have failed initial treatment and are considering systemic versus local salvage therapy.

ProstaScint is a technically demanding test both for the technologist to properly acquire and process and for the physician to correctly interpret. Proper patient preparation and appropriate acquisition and processing parameters are crucial. ProstaScint is injected slow IV via butterfly. The patient is positioned with penile blood pool at the bottom and the kidneys near the top of the field of view. Inclusion of these structures ensures the prostate (or the prostatic fossa) and lymph nodes in the pelvis, retroperitoneum and mesentery are not excluded. The patient and camera location are marked to allow for identical positioning for the immediate and delayed SPECT acquisitions. SPECT images of the pelvis and abdomen are obtained 30 minutes post injection to determine blood pool anatomy and repeated 3-5 days post injection along with whole body planar imaging. Additional delayed SPECT is required if the blood pool activity has not cleared sufficiently or if there is bowel activity in the region of the lymph nodes interfering with image interpretation.

Both photopeaks of Indium-111 are used, each with a 20% window. SPECT images are acquired for 20 seconds (day 0) or 40 seconds (day 3 to 5) per stop for 64 stops. Whole body imaging may be done as a sweep at 4cm/min from the head to the top of the knees or as individual spots (600 seconds/image) of anterior and posterior chest, abdomen and pelvis.

Processing parameters vary with camera manufacturer's equipment and with individual physicians' reading preference. Care must be taken to avoid selecting parameters that are too noisy which may "create" disease or too smooth which may obscure disease. Processing errors can lead to false positives and false negatives. Utilizing a dual headed ADAC Genesys camera with a Pegasys computer, we recommend a 64X64X16 matrix and a Butterworth filter, order of 1 and cut-off frequency of 0.6.

No. 1464

EFFECT OF PRONE VERSUS SUPINE IMAGING WITH CEA-SCAN® ON CANCER DETECTION IN PATIENTS WITH BREAST ABNORMALITIES. D. A. Erb, H. A. Nabi, D. Rosner. Departments of Nuclear Medicine, and Gynecology and Obstetrics, State University of New York at Buffalo, Buffalo, NY.

The aim of this study is to evaluate the effect of positioning (prone-dependent vs. supine) on breast lesion detection following immunoscintigraphy in patients with indeterminate mammograms with Technetium (Tc) 99m CEA-Scan®.

Patients were imaged 4 to 5 hrs. post injection of 20-30 mCi Tc99m CEA-Scan®. Images were obtained for one million counts each. Prone- dependent images were performed with an overlay table designed specifically for breast imaging. Prone and supine scans were blindly read and scored on a scale of 0 (negative) to 3 (definitely positive) for breast cancer. Scores were compared to histopathological findings.

	Lesions	PRONE	Lesions	SUPINE
Sensitivity	4/11	36%	5/11	45%
Specificity	7/21	33%	16/21	76%
NPV	7/14	50%	16/22	73%
PPV	4/18	22%	5/10	50%

Prone views tended to enhance normal breast architecture and prominent ductal patterns, leading to misinterpretation in 14/30 patients.

In summary, we found that prone-dependent breast imaging with CEA-Scan® tended to increase the false positive rate.

No. 1465

PREOPERATIVE LYMPH NODE STAGING OF SQUAMOUS CELL CARCINOMA OF HEAD AND NECK BY FDG-PET. M. Müller-Berg, J. Hoffmann, R. Lietzenmayer, B.M. Dohmen, N. Schwenzer, R. Bares.

Departments of Nuclear Medicine and Oral and Facial Surgery, Eberhard-Karls-University, Tübingen, Germany.

Lymph node staging is of paramount importance for prognosis and treatment of head and neck tumors. Currently used CT, MRI, and ultrasonography are evaluating lymph node size and shape to detect metastases. These morphological criteria, however, are unspecific, since even small lymph nodes may harbor tumor cells while lymph node enlargement might also be due to inflammation. Purpose of this study was to assess the use of 18-FDG-PET for classification of cervical lymph nodes in squamous cell carcinoma (SCC) of head and neck.

Seventeen patients with suspected SCC and enlarged lymph nodes were studied so far. Static PET scans (2 x 20 min.) of head and neck were obtained 40 min. after i.v. injection of 350 MBq 18-FDG. Attenuation correction was achieved by measured transmission data. Image analysis was performed visually as well as quantitatively by calculating standardized uptake values (SUV) of FDG. Validation was achieved by histology of the removed lymph nodes analyzing supra- and infraomohyoidal nodes separately.

In eight out of 34 regions metastatic lymph node involvement was found. PET showed positive findings in all of them (SUV 4.11 ± 1.2; range = 2.4 - 6). In 26 regions no metastases were disclosed by histology. PET was true negative in 23 of them although nearly all lymph nodes revealed signs of chronic lymphadenitis of various degrees. False positive findings were obtained in three regions (SUV 2.6 ± 0.6; range = 1.9 - 3). Applying a SUV-cutoff of 2.0 correct lymph node classification was achieved in 32 out of 34 regions (94%) with no false negative and two false positive results.

We conclude that FDG-PET appears to be a highly reliable technique for lymph node staging in SCC of head and neck, in particular functional classification of enlarged lymph nodes.

Session 206

Oncology

2:15-3:45 p.m.

Room: 205

No. 1466

F-18 FDG-SPECT IN ONCOLOGY: COMPARISON WITH FDG-PET. S.A. Barrow, A.J. Fischman., Massachusetts General Hospital, Boston, MA.

F-18 FDG PET is rapidly becoming an important imaging procedure for diagnosis, staging and therapeutic monitoring of a variety of tumors. Unfortunately, due to the cost and complexity of the instrumentation that is required, utilization of this procedure has been limited to large academic centers. Recently, several instrument manufacturers have introduced ultra high energy (UHE) collimators that can be used to image the 511 Kev photons with conventional gamma cameras. In this report we describe our experience with this technique.

A series of patients with a variety of malignancies (lung, esophagus, pancreas, breast and lymphoma) were studied with F-18 FDG PET and SPECT. The patients were fasted and I.V. infusions containing glucose were stopped for at least 12 hrs prior to imaging. 10-15 mCi of F-18 FDG were injected and after a 45 min. uptake period, images were acquired with a GE-PC4096 PET camera. The patients were then positioned in the gantry of dual detector SPECT camera equipped with UHE collimators (Siemens, MS2) and peaked for 511 Kev photons (15% window). SPECT acquisition was performed over 360°; 96 - 14 sec frames. The FDG SPECT images were reconstructed using a Butterworth filter (cutoff ~0.5, order 5) and compared with the PET data.

In all cases, diagnostic quality images of the main site (s) of tumor involvement were obtained with both PET and SPECT. However, in several cases, small areas (<1.5 cm) of low intensity FDG accumulation that were detected by PET were not identified by SPECT. In addition, as expected, lesion borders, margins and contours were considerably less well defined by SPECT compared with PET. However, due to the larger field of view, some lesions were detected only by SPECT.

These results indicate that FDG SPECT has several important characteristics. Most large lesions are easily detected. Large field of view improves anatomic coverage. Dual photon imaging can be performed with Tc-99m-MIBI, Ga-67, radiolabeled antibodies, etc. Most importantly, it opens metabolic imaging to almost every Nuclear Medicine facility.

No. 1467

Sentinel Lymph Node Localization Using Tc-99m Human Serum Albumin in Patients Diagnosed with Primary Melanoma. M.L. Merry J.J. Kozar, C. Helsabeck, A.M. Scheff. University of Pennsylvania Medical Center, Philadelphia, PA.

Purpose: To determine whether lymphoscintigraphy using Tc-99m Human Serum Albumin (HSA) can accurately identify the first draining or sentinel lymph node in patients with malignant melanoma.

Methods: Prior to imaging 18.5Mq Tc-99m HSA are injected intradermally at four sites around the lesion scar. Serial imaging (128 X 128) is then performed to identify the lymphatic drainage routes and localize the sentinel lymph node. Static images are performed in as many planes as necessary to permit accurate skin marking of the sentinel node. An indelible mark is made on the skin with the patient positioned as anticipated during surgery.

Results: Of the thirty patients studied to date, 86% had successful sentinel node localization. Ten of fifteen (66%) axillary and all fifteen groin sentinel nodes were identified. Factors which contributed to failed localization include poor injection technique (intramuscular/subcutaneous), marking the axilla when patient is not in surgical position and failure to localize an axillary node with both anterior and lateral views. Techniques that may increase accuracy include SPECT imaging, region of interest analysis, and the gamma probe.

Conclusions: Tc-99m HSA is an accurate agent for sentinel lymph node detection. With proper technique the node can be localized in thirty to sixty minutes. Localization of axillary sentinel nodes may be improved with surgical positioning of patient's arm and imaging in multiple planes.

No. 1469

ARE 4 HOUR OCTREOSCAN IMAGES AS DIAGNOSTIC AS 24 HOUR IMAGES? R.K. Halkar, P.L. Corrigan, S.C. Herda, S.F. Grant, J.R. Galt, N.P. Alazraki and A.T. Taylor, VAMC (Atlanta) and Emory University Hospital, Atlanta, Georgia.

In-111 pentetrotide (Octreoscan) has excellent 4 hour plasma clearance and has significant bowel excretion at 24 hours. Hence we hypothesized that a 4 hour Octreoscan image has as much diagnostic information as a 24 hour image and will have less bowel activity.

To test this hypothesis 3 experienced readers independently reviewed 4 hour and 24 images of 37 studies in 31 patients (mean age=49, M:F=17:14). Referral diagnoses were pheochromocytoma (10), carcinoid (4), gastrinoma (4), medullary carcinoma (3), insulinoma (3) and other neuro endocrine tumors (7). All studies had 4 and 24 hour whole body planar images and SPECT at 24 hours. Images were obtained with a dual head camera using 20% energy windows centered on 173 and 247 keV peaks.

In 16 studies 4 hour images (12 patients) were found to be positive by all three readers and were concordant with the 24 hour images. Twenty-one studies were negative at 4 hour and 24 hour planar images and also by 24 hour SPECT images.

In 2 cases where 4 hour SPECT was available, all three readers agreed that 4 hour was more diagnostic because of less bowel activity. Only in 1 study the 24 hour planar image showed 2 lesions in the mediastinum where as the 4 hour planar image showed only one lesion (4 hour SPECT had not been performed).

Our results showed that 4 hour Octreoscan planar images are as diagnostic as 24 hour planar images and 4 hour SPECT may be superior especially for abdominal pathologies and further prospective studies including 4 hour SPECT acquisitions are needed.

No. 1468

THE USE OF TC-99m SULFUR COLLOID LYMPHO-SCINTIGRAPHY FOR SELECTIVE LYMPHADENECTOMY IN PATIENTS WITH MALIGNANT MELANOMA. J. Patel, S. Kim, J. Kairys and C. Intenzo. Thomas Jefferson University Hospital, Philadelphia, PA.

Lymphoscintigraphy (LS) is an effective procedure to guide the surgeon in excision of sentinal lymph node (SLN) in the operating room using a hand held gamma probe without the morbidity of radical lymph node dissection in patients with malignant melanoma. The majority of biopsies can be performed under local anesthesia as an out-patient as compared to a total lymph node dissection with general anesthesia and a hospital admission.

Patients are given intradermal injections of 100 uCi of Tc-99m Sulfur Colloid at approximately one centimeter from the tumor site at the 12:00, 3:00, 6:00, and 9:00 o'clock positions. Tc-99m Sulfur Colloid was filtered with a 0.2 micron filter, to get the smallest particles possible. Dynamic flow images were obtained at 30 seconds per frame for 30 minutes followed by a series of static images obtained every 5 minutes for another 30 minutes. SLN and multiple drainage pathways were identified in all patients. These nodes were then marked on the skin surface using permanent ink marker for lymphadenectomy. A total of 14 SLN in 6 patients were evaluated, among these 13 SLN were negative for tumor and 1 SLN was positive. The patient with positive SLN had undergone radical lymph node dissection.

We conclude that lymphoscintigraphy a) reliably localizes the SLN drainage site b) guides the surgeon for lymphadenectomy using hand held gamma probe and c) benefits patients since the surgical procedure can be performed under local anesthesia as an out-patient.

No. 1470

RADIOLABELED LEUKOCYTES WITH HYPOTONIC LYSIS METHOD. S. Chowdhury, J.C. Hung, L.A. Forstrom, and B.P. Mullan. Nuclear Medicine, Department of Diagnostic Radiology, Mayo Clinic, Rochester, MN.

Separation and labeling of human leukocytes with In-111-oxine or Tc-99m-exametazime is a standard technique to look for infection and inflammatory disease. However, the radiolabeled leukocyte preparation usually contains various cellular contaminants (i.e., erythrocytes, platelets, and lymphocytes). Additionally, with the regular volex sedimentation technique to isolate leukocytes, there may be significant loss of leukocytes during the separation procedure. Consequentially, a pure granulocyte preparation is generally desired for the evaluation of vascular graft infection and may be helpful in the detection of suspected hip and, to a lesser extent, knee prosthesis infections, where blood pool activity can complicate interpretation. On review of our clinical studies, we feel that the hypotonic lysis technique is the best method in which to separate leukocytes, as it virtually guarantees a final preparation free of erythrocytes. To further remove platelets and lymphocytes, one can apply a single-gradient Ficoll-Hypaque (gradient I, specific gravity = 1.08 g/ml) to obtain pure granulocytes. Since a hypotonic lysis medium is used in both methods, questions remain as to the viability and function of leukocytes - especially neutrophils. We have conducted viability testing using trypan blue and chemotactic migration testing on samples obtained with either the hypotonic lysis method or single-gradient Ficoll-Hypaque with hypotonic lysis method, and have found no difference in size, shape, or stability between the regular and lysis methods. Using the lysis method for the separation of leukocytes or pure granulocytes, we have found that less time and cost are required without any significant loss of leukocytes in the separation process. It also appears that In-111-oxine-labeled leukocytes prepared with the hypotonic lysis method does not result in abnormal or unusual leukocyte distribution following re-injection, particularly in the liver and spleen. In conclusion, we believe that the hypotonic lysis method and single-gradient Ficoll-Hypaque with hypotonic lysis method are two superior methods for separation of leukocytes and pure granulocytes, respectively.

No. 1471

A PROCESS FOR SAFE, EFFICIENT RADIOIODINE THERAPY IN THE CARE AND MANAGEMENT OF THE THYROID CANCER PATIENT. J. Fry, R.D. Reid, G.H. Hinkle. The Ohio State University Medical Center, Columbus, OH.

The purpose of the study was to evaluate the process of providing efficient care and management of radioiodine therapy of the thyroid cancer patient. The entire process from pre-admission testing, iodine-131 whole body imaging through therapy administration and hospital discharge was reviewed to determine where improvements could be made. A patient flow tracking form was implemented to determine where delays occurred. A patient satisfaction survey was developed and data collected to identify areas in need of improvement. Bioassays were performed on all nursing staff having direct contact with therapy patients.

The patient flow tracking form showed delays in dosing and release times were due to several variables including waiting for required laboratory blood work and individual patient transportation needs. A strong correlation with age and time of discharge also emerged. An interactive CD-ROM was developed to improve patient education as a result of the patient satisfaction survey. The CD-ROM will also be used in further education of nursing staff and ancillary personnel. Bioassays of nursing personnel showed values below or within action limits (300 nCi or 11.1 kBq) set by the Office of Radiation Safety at The Ohio State University.

Increased awareness and improved interaction of the staff has had a favorable effect on the efficiency of care and management of the thyroid cancer patient.

POSTER SESSIONS

The following scientific papers will be presented as poster presentations. Posters may be viewed throughout the meeting in the Exhibit Hall on the first level of the San Antonio Convention Center. Exhibit Hall hours are: Monday–Wednesday 7:00 a.m.–7:00 p.m.; Thursday 7:00 a.m.–10:00 a.m.

Posterboard No. 1500

THE INCIDENCE OF BLOOD CONTAMINATION OF LEAD PIGS WITH AND WITHOUT PROTECTIVE INSERTS IN DISPENSING COMMERCIALY PREPARED RADIOPHARMACEUTICALS. M.W. Pickett, J.E. Kosegi, K.S. Thomas, and K.M. Waterstram-Rich. University of Arkansas for Medical Sciences, Little Rock, AR; Indiana University, Indianapolis, IN; City of Hope Medical Center, Duarte, CA; and Rochester Institute of Technology, Rochester, NY.

This investigation was undertaken to evaluate the effectiveness of disposable plastic inserts in radiopharmaceutical unit dose lead pigs in preventing distribution of doses in blood contaminated containers. The process by which technologists dispose of used radiopharmaceutical syringes by not recapping the needle and placing the uncapped syringe directly into the lead pig has raised the question of unsuspected blood contamination of these pigs. Consequently, the distribution of commercially prepared radiopharmaceutical doses in reusable lead pigs may result in radiopharmaceutical doses being repeatedly distributed throughout the nuclear medicine community in containers that are contaminated with blood. Using a simple chemical wipe test specifically designed to determine the presence or absence of blood contamination, 618 pigs from commercial radiopharmacies throughout the USA were tested for contamination. The inside of the pigs and inserts (if present) were wiped both before and after dose administration. Of the pigs that were tested, 292 came from radiopharmacies that used a protective, disposable plastic insert inside the pig, and 326 came from radiopharmacies that did not use an insert. Of those pigs without the protective disposable inserts, 39% of the doses that came from the radiopharmacies arrived in the nuclear medicine department in pigs contaminated with blood. Of those pigs with the insert, 1.6% of the doses arrived in pigs that demonstrated blood contaminated inserts. After injection of the dose and replacement of the syringe into the pig, 46% of pigs without inserts were contaminated with blood, and 3% of the inserts in the pigs were contaminated. In conclusion, the proper use of plastic, disposable inserts significantly reduces the possibility of distributing doses in blood contaminated containers.

Posterboard No. 1501

IDENTIFICATION OF PHOTON DEFICIENT BRAIN SPECT ARTIFACT CAUSED BY METALLIC PLATES. M.T. Hackett, W.-J. Shih, V.H. Stipp, and S.L. Magoun. Department of Veterans Affairs Medical Center, Lexington, KY.

Over the last few years, we have performed several brain SPECT studies on patients that have had previous head trauma that required placement of a metallic plate into the skull. The axial slices from the SPECT studies demonstrated clearly defined photon deficient areas extending from the brain tissue into the soft tissue (scalp). We performed several brain SPECT phantom studies using various metals to simulate a metallic plate to study the extent and pattern of this type of artifact. In a review of the surgical literature, aluminum, stainless steel, and tantalum (reported thickness used: .064; .046; .038 cm, respectively) have been used for cranioplasty. We utilized available non-surgical grade aluminum, stainless steel, and lead sheets (3.5x5 cm with thickness of .064; .061; .076 cm, respectively). We were unable to obtain tantalum, therefore, we utilized lead and estimated its thickness based on similar attenuation factors using tungsten's mass attenuation coefficient (Z number close to tantalum) and tantalum's density. Brain SPECT phantom studies were obtained using typical clinical set-up and count rates with the various metal sheets in place. Axial slices were reviewed. The phantom studies with either aluminum or stainless steel yielded no discernible photon deficient areas. The phantom studies using lead were similar to our patient studies: a defined photon deficient area in normal brain tissue that extended into the area where normal scalp activity would be. Also, there was increased tracer

activity at the periphery of the photon deficient area where normal scalp activity would be. This activity was not present when the lead sheet was removed and the phantom study was repeated. Again, this is similar to our patient studies. This artifact is caused by tracer attenuation from the metallic plate which results in back-projection errors. The surgical literature states that both aluminum and stainless steel are radiolucent while tantalum is radiopaque which is clearly evident in our brain SPECT phantom studies. The degree of attenuation caused by the metallic plate will be directly related to the quality of the SPECT study. A brain SPECT study done on a patient with a radiopaque metallic plate will yield a clearly defined photon deficient area extending from the brain tissue into soft tissue (scalp) with increased tracer activity in the soft tissue at the periphery of the photon deficient area. One should be aware of this type of photon deficient artifact, and it should be correlated with skull radiographs and a detailed patient history involving previous head trauma/surgery.

Posterboard No. 1502

PATHOPHYSIOLOGY OF MIGRAINE HEADACHES USING POSITRON EMISSION TOMOGRAPHY. D.L. Milko, M.B. Wiseman, S.W.G. Derbyshire, J.A. Ruszkiewicz, D.A. Manthei, M.J. Soso, G.K. Urso, D.W. Townsend, C.C. Meltzer. The PET Facility, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania.

Previous studies using positron emission tomography (PET) have described hypoperfusion during migraine attack (Weiller et al, 1995; Woods et al, 1994). The serotonin 5-HT_{1D} receptor agonist Sumatriptan is widely thought to relieve migraine through a reduction in vascular dilation. However, some findings suggest that migraines may originate neuronally as well as vascularly. This study examined the relationship between regional cerebral blood flow (rCBF) and regional cerebral metabolic rate of glucose (rCMR_{glu}). Fourteen subjects with recurrent migraines were studied using standardized PET procedure in conjunction with [O-15]water and [F-18]FDG. Two rCBF images were acquired using [O-15]water and one image of rCMR_{glu} using [F-18]FDG during migraine and non-migraine states on separate days. Statistical Parametric Mapping (SPM) analysis showed significant (p<0.01) increased rCBF during migraine in the left somatosensory cortex (S1), the right premotor (area 6), somatomotor (areas 1,2,3,4) cortices, and bilateral parahippocampal gyrus (PHG). Significant decreases in rCBF were seen in the right temporal (area 21), anterior cingulate (area 24), medial frontal (area 32) cortices, and left insula, perigenual cingulate (area 25), inferior parietal (area 40), posterior cingulate (area 23/31) cortices and the cerebellum. Significantly increased rCMR_{glu} (p<0.01) was seen in the right PHG, temporal (area 21), prefrontal (area 9) cortices and in the bilateral occipital cortex (area 18). Decreases in rCMR_{glu} occurred in the right inferior parietal cortex (area 40), lentiform nucleus, and bilateral thalami. The rCBF and rCMR_{glu} changes were thus largely decoupled, suggesting that migraines have both a vascular and a neuronal basis that operate independently. Support received by GlaxoWellcome Research Institute.

Weiller C, May A, Limmroth V et al. Nat Med (1995) 1: 658-660.
Woods RP, Jacoboni M, Mazziotta JC. N Engl J Med (1994) 331: 1689-1692.

Posterboard No. 1503

A COMPARISON OF 2D AND 3D WHOLE BODY IMAGING WITH THE ECAT HR+. M.A. Dachille, D.W. Townsend, P.E. Kinahan, T. Beyer and C.C. Meltzer. PET Facility, Department of Radiology, University of Pittsburgh, Pittsburgh, PA.

The ECAT HR+ is a 24-ring scanner with an axial field-of-view

(FOV) of 15.2 cm. The scanner has an in-plane resolution of 4.5 mm and an axial resolution of ~ 4 mm. Retractable septa enable the tomograph to be operated in both 2D and 3D mode, with 3D providing an increase in sensitivity by a factor of 5 compared to 2D. However, for whole body imaging, although the increased 3D sensitivity offers advantages of a lower injected dose, improved image statistics, or shorter scan times, a major drawback is a significant increase in randoms and scatter from unshielded activity outside the FOV. Sources of such activity include brain, heart, and particularly the bladder. Correction for scatter due to activity outside the FOV is not routinely incorporated into the model-based scatter correction method supplied with the HR+. It is important, therefore, to carefully select the appropriate imaging protocol in 3D to avoid compromising the increase in sensitivity by an even greater increase in background noise due to randoms and scatter. A typical study consists of an injection of 6-10 mCi of FDG, a 45 minute uptake period, followed by an emission acquisition of 6 mins/bed position at 6 or 7 bed positions, with a 1 cm overlap between bed positions in 2D and a 4 cm overlap in 3D. The emission scan is followed by a post-injection, windowed transmission scan acquired for 3 mins/bed position. Care is taken in patient preparation to reduce contaminating background from FDG activity in the heart and bladder. The complete study takes about two hours, and is generally well tolerated by the patient. We compare protocols appropriate for clinical whole body imaging on the HR+ in both 2D and 3D, with and without attenuation correction. Results are presented for a whole body phantom and for a selection of patient studies acquired in 2D and 3D.

Posterboard No. 1504

RADIOIMMUNOTHERAPY WITH Y-90 LABELED MONOCLONAL ANTIBODIES: PRACTICAL CONSIDERATIONS FOR THE TECHNOLOGIST. P.F. Cutrer, A.M. Zimmer, M.W. Groch, W.G. Spies and S.M. Spies. Northwestern University Medical Center, Chicago, IL.

Investigational radioimmunotherapy trials utilizing Y-90 labeled monoclonal antibodies include radiation dosimetry, which is accomplished with In-111 labeled monoclonal antibodies. Our laboratory has performed multiple radioimmunotherapy trials and has established a general diagnostic imaging protocol using In-111 labeled monoclonal antibodies to determine radiation dosimetry prior to therapeutic Y-90 antibody administration. The protocol involves sequential multiple imaging beginning several hours and lasting several days (up to 7 or 8 days) after radiolabeled antibody administration. Along with this protocol, an In-111 standard (50 -200 uCi) needs to be simultaneously imaged to quantitate In-111 uptake. Included in the protocol is serial blood sampling to assess blood clearance and estimate Y-90 dose to bone marrow. The imaging protocol consists of simultaneously acquired anterior/posterior scans along with the In-111 standard. In our lab we utilize a dual head whole body camera for imaging interfaced to a nuclear medicine computer. Through a computer protocol, regions of interest can be drawn to delineate tumor sites and critical organs and tracer uptake can be quantified by comparing counts to a known standard in the same field-of-view. In summary, a practical guide for the delivery of In-111 antibody, imaging, blood collection, Y-90 dose determination and subsequent Y-90 antibody administration has been created. The guide illustrates possible patient and logistical problems and emphasizes that care must be taken to ensure standardization of methods for accurate results.

Posterboard No. 1505

THE EFFECT OF RECONSTRUCTION FILTER ON LEFT VENTRICULAR EJECTION FRACTION OBTAINED FROM QUANTITATIVE GATED SPECT (QGS). S.M. Leonard, M.W. Groch, S.M. Spies, S. Shah, P.F. Cutrer, and R. C. Hendel. Northwestern University School of Medicine, Chicago, IL.

Gated myocardial perfusion SPECT imaging with Tc-99m agents not only provides assessment of myocardial perfusion, but also may provide the ability to quantitate ventricular function. One such quantitative program, QGS (Cedars Sinai Medical Center, Los Angeles, CA), has been developed,

and has recently become available at a number of clinical sites. The ability of any QGS program to accurately and reproducibly quantitate left ventricular ejection fraction (LVEF), should depend on a number of factors, including the effective spatial resolution and the image noise content of the SPECT image. Since the choice of a reconstruction filter affects these parameters, we evaluated various filter cut-off frequencies, and their effect on the LVEF value generated by QGS. Four patients, three with normal ventricular function and one with reduced LV function were evaluated using four values of filter cut-off. For this study the reconstruction filter type was fixed as the Butterworth filter, and cut-off values of 0.2, 0.4, 0.6, and 0.8 Nyquist were used to reconstruct each patient's SPECT scan. Results: The magnitudes of LVEF obtained by QGS varied by as much as 0.13, 0.07, 0.04, and 0.12 for each of the four patients studied with the four differing cut-off frequencies. The respective standard deviations of the four LVEFs obtained for each patient were 0.065, 0.031, 0.017, and 0.066. The most significant deviation in LVEF magnitude was observed at the 0.2 cut-off value, typically yielding the highest value of LVEF. Cut-off values in the range of 0.4 to 0.7 (those common for Tc-99m perfusion SPECT imaging) yielded essentially identical values of LVEF. We conclude that the cut-off frequency of the reconstruction filter has some effect on the LVEF value obtained by QGS. However, in the range of cut-off frequencies typically used in nuclear cardiology, the value of LVEF remains largely constant, in this limited study.

Posterboard No. 1506

Rapidity of radioligand (Tc-99m P280) binding to GP IIb/IIIa receptors on the surface of activated platelets in the detection of acute deep venous thrombosis (DVT): I.M. Kreis, G.T. Krishnamurthy, T.K. Walsh, F.M. Swailen. V.A. Medical Center and University of Arizona, Tucson, AZ.

Purpose: To find out how rapidly Tc-99m P280 (Diatide Inc. Londonderry, NH) binds to glycoprotein (GP) IIb/IIIa receptors on the surface of activated platelets of an acutely forming DVT which may be crucial in determining the optimum imaging time interval following i.v. injection of the radioligand.

Methods: Fourteen patients with suspected acute DVT were injected with 10mCi Tc-99m P280 into each pedal vein after applying three tourniquets on each limb. Calf, popliteal and femoral vein images of both limbs were obtained (tourniquets off) between 10-30 min, 45-60min, and 60-90 min with a gamma camera by accumulating 500 to 1000 K counts per image. Thrombus/ normal vein ratio was obtained by drawing equal region of interest over the thrombus and the contralateral normal vein

Results: In 6 patients with first episode of acute DVT, the mean (S.D) thrombus/ normal vein ratio at 10-30 min was 1.58 ± 0.22 , 1.78 ± 0.29 , and 1.52 ± 0.29 , respectively, over the calf, popliteal and femoral veins. The mean ratio at 45-60 min was 1.70 ± 0.41 , 1.73 ± 0.17 , and 1.58 ± 0.34 and the ratio at 60-90 minutes was 1.88 ± 0.22 , 1.78 ± 0.13 , and 1.72 ± 0.34 over calf, popliteal and femoral veins, respectively, and were not significantly different from 10-30 minute ratios. In the remaining 8 patients with recurrent DVT, thrombus / normal vein ratios tended to be slightly lower but showed no significant difference in mean ratio at 10-30, 45-60, 60-90 minutes.

Conclusion: Tc-99m P280 bind to GP IIb/IIIa platelet receptors on the thrombus on first contact during its transit through the veins suggesting that the diagnosis of acute DVT may be made from images obtained between 10-30 minutes when the ligand is injected directly into the foot veins.

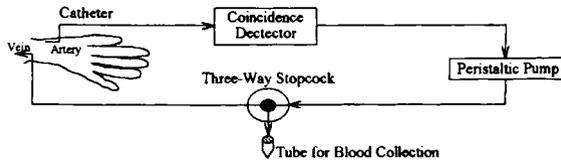
Posterboard No. 1507

CLOSED-RECIRCULATION LOOP IN AUTOMATED BLOOD SAMPLING SYSTEM FOR POSITRON EMISSION TOMOGRAPHY. S.L. Chang, K.L. Chou, R.S. Liu, and S.H. Yeh. Taipei Veterans General Hospital, National PET/Cyclotron Center, and National Yang-Ming University School of Medicine, Taipei, Taiwan.

The accuracy of the input function is of paramount importance for obtaining correct model parameters which is essential for determination of the physiological information in fast dynamic function studies with positron emission tomography (PET). Automatic blood sampling systems (ABSS) have been proved superior to the manual routine. They demand minimum manual intervention and thus reduce the radiation hazard to the staffs, and reduce the sampling interval as well. However, the amount of blood loss by the automated system is much more than the manual method if continuous pumping is acquired. It takes about 200 ml of blood

in a routine 2-hr dynamic PET study. In addition, if we stop the sampling machine running at the intervals, the cleansing of the catheter with heparinized saline to avoid clotting of the blood in the tube is tedious. Thus, we design a closed-recirculation loop in the automated blood sampling system (CRABSS) to solve the problems mentioned above.

The CRABSS consists of a coincidence detector, a peristaltic pump, a data-logger, an arterial sampling catheter, and a venous return catheter. The arterial sampling catheter is 100 cm long. The detector is placed 60 cm from the tip of the arterial catheter. The arrangement of the CRABSS is shown below.



Determination of the input function of $[O-15] H_2O$ was done using CRABSS and an open automated blood sampling system alternatively. The dispersions of the global data from CRABSS and open ABSS were almost identical. No influence on the blood curve by the recirculated blood was observed.

We conclude that the CRABSS is a reliable automated sampling system and has the advantage of less blood loss for patients, especially the children.

Posterboard No. 1508

TECHNICAL CONSIDERATIONS IN IMAGE FUSION OF COMPUTED TOMOGRAPHY AND INDIUM-111 PENTETREOTIDE SPECT IMAGES IN PATIENTS WITH NEUROENDOCRINE TUMORS. J.P. Fry, G.H. Hinkle, J.O. Olsen, R.V. Pozderac and W.F. Bennett The Ohio State University Medical Center, Columbus, OH.

The purpose of the study was to compare image fusion techniques using external markers and internal landmarks when registering computed tomography (CT) and indium-111 pentetrotide (In-P) images.

Thirty-seven patients having abdominal CT studies and In-P whole body images were selected for image fusion. A minimum of three internal landmarks were used for registering the two studies. These landmarks included superior or inferior poles of the kidneys, dome of the liver and tip of the spleen. In five cases, external markers were placed on the patient prior to SPECT imaging and remained in place for the CT study which was completed later that day. Three external markers, each containing approximately $2 \mu Ci$ ($74 kBq$) of radioactivity, were adhered to the patient at the xyphoid process along with the left and right iliac crests.

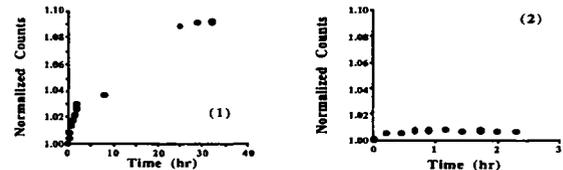
Internal landmarks proved to be the preferred method for image fusion of CT and In-P studies. External landmarks had a tendency to shift due to the patient's position from one imaging table to another. Containment of the radioactivity on the patient when the CT study did not immediately follow the In-P study was a concern on the part of the Office of Radiation Safety. Finally, the sequence in which radiologic studies are completed does not always lend itself to using external landmarks. Many of the CT studies were completed 1-3 weeks prior to the In-P study. The utilization of internal landmarks has the added advantage of allowing longer temporal separation of the abdominal CT and the In-P procedures (i.e. days to weeks).

Posterboard No. 1509

EFFECT OF PROLONGED ABSENCE OF RADIOACTIVITY ON THE GLOBAL SENSITIVITY OF A PET TOMOGRAPH. D.A. Rich, R. Soufer, C.K. Ng. Yale University-VA Positron Imaging Center, West Haven, CT.

The stability of count sensitivity in a PET tomograph is mostly dependent on the consistent performance of the photomultiplier tubes (PMT). The sensitivity of our Posicam 6.5 tomograph, which consists of 720 PMTs, is routinely monitored with a 20 cm cylindrical phantom containing 250 nCi/cc of Ge-68. It was observed that the sensitivity of the tomograph decreased by as much as 6% after a weekend and increased as the week progressed. This degree of fluctuation may potentially compromise the integrity of the dynamic data used for quantification. Therefore two experiments were performed to further investigate this problem. First the tomograph was not exposed to any radioactivity for more than 48 hours. Then the Ge-68 phantom was placed in the tomograph and sensitivity measurements were taken at irregular intervals. The second experiment was repeated with similar measurements except that the system was constantly exposed to a source of radioactivity over the

weekend. All data were normalized to the first measurement in each experiment. Results from the first experiment (graph 1) demonstrate a rapid change in global sensitivity over the first 6 hour period, approaching a plateau after 30 hours. In contrast, results from the second experiment (graph 2) demonstrate no significant change in global sensitivity over a 2 hour period. A possible explanation for this phenomenon is that Cs gas leached off of the PMT's photocathode causes a decrease in gain during periods of no radioactivity exposure. Further investigation, however, is needed to determine the causality. In conclusion, these data indicate that the global sensitivity of our system could be stabilized by constantly exposing the detectors to radioactivity.



Posterboard No. 1510

WEIGHT AND DENSITY OF Sr-89 SOLUTIONS USED TO DETERMINE CORRECTION FACTORS FOR DOSE CALIBRATOR MEASUREMENTS. M.T. Hackett, and J.J. Coupal. Dept. of Veterans Affairs Medical Ctr., Lexington, KY.

Though not required by the Nuclear Regulatory Commission to measure radioactivity in unit doses of beta-emitting radionuclides obtained from a licensed manufacturer or preparer, on-site assay of strontium-89 chloride (Sr-89) to prevent accidental injection of a wrong radiopharmaceutical (e.g., standard 4 ml dose drawn from different vial) seems prudent. The purpose of this study was to determine the most reproducible method for establishing a correction factor (CF) for assay of Sr-89 in a dose calibrator (DC), that can then be used for future direct Sr-89 measurements therein.

Six Sr-89 glass-vial unit doses from manufacturer, 148 MBq (4 mCi) in 4 ml, were tested on 5 separate days. DC assays at various potentiometer settings (PS) were obtained on the vial (pre- and post-dose removal) and the dose in a 5 ml plastic syringe. The net weight of each dose in a shielded syringe was measured (to 5 decimals) using an analytical balance to calculate the dose volume (dose weight divided by the manufacturer-stated average density, 1.014 g/ml). CFs based on the predicted decay-corrected activity divided by the DC assay at each PS were calculated using these four methods:

- 1) Assay of vial (pre-dose removal) and stated total vial activity,
- 2) Assay of syringe and dose activity based on the radioactivity concentration and on the volume read off of the syringe,
- 3) Assay of vial (pre- minus post-dose removal) and dose activity based on the radioactivity concentration and the dose volume derived from the dose weight, and
- 4) Assay of syringe and dose activity based on the radioactivity concentration and the dose volume derived from the dose weight.

From those methods, mean and standard deviation of CFs were calculated for each PS. From those data, a range of coefficients of variation (%) were found:

- 1) 2.3-2.7, 2) 2.1-2.3, 3) 0.8-1.3, and 4) 0.7-0.8, respectively.

Methods 3 & 4 using dose weight to determine volume, have less variability than do methods 1 & 2 (latter, however, are commonly used for establishing CFs). The use of the dose weight eliminates some variables in measuring the activity (e.g., method 1: radioactivity of vial-fill is actually within $\pm 10\%$ of claimed; method 2: volume errors due to inter-syringe capacity variations and from air bubbles within) but is still prone to geometry variations and varying levels of Sr-85 contaminant.

Posterboard No. 1511

RADIATION SAFETY ASPECTS OF MICROWAVE OVEN USE DURING RADIOPHARMACEUTICAL PREPARATIONS. M.T. Hackett, and J.J. Coupal. Department of Veterans Affairs Medical Center, Lexington, KY.

Over the past several years, use of the microwave oven for radiopharmaceutical preparations has increased at our institution. Reported breakage of Tc-99m sestamibi vials during various heating methods and its potential for airborne and surface radioactive contamination prompted us to re-evaluate our procedures. We report on our experiences with microwave use pertaining to radiation safety.

We evaluated (a) the use of a heating time that yielded vial contents' temperatures $< 100^\circ C$, (b) vial confinement in either Styrofoam or lead during cooling, (c) the use of lead shielding of and placement of oven in a fume hood, and (d) procedures for handling of the radioactive vial.

One radiation safety precaution that we have used over the past several years has been the use of Styrofoam that totally encompasses the reaction vial during heating. That would confine radioactive contamination if vial breakage occurred. To minimize vial breakage, a shortened heating time limits the vial contents' maximum temperatures to

<100°C. Using that method, the heated vial is immediately placed in Styrofoam that is lead shielded and allowed to cool spontaneously for 10 minutes. The Styrofoam acts as a heat insulator, thereby slowing the cooling process compared with that in a lead vial shield. In some cases, if the vial were cooled in a lead vial shield, the radiochemical purity was unacceptable (<90%). To limit potential staff exposure from airborne radioactivity in the case of vial breakage during heating, the microwave was placed in a fume hood. That placement did affect the sash level height needed to maintain optimal airflow. To maximize usage of the fume hood, the microwave base was turned 90° clockwise and the oven periphery (top, bottom, and left side facing preparer) shielded with sheet lead. That still allows easy access to the shielded microwave cavity during use. To minimize hand exposure, we use a Styrofoam holder with a flip-up lid whose base is attached to the center of the oven's rotating plate with a Velcro patch. Tongs are used to manipulate the vial and the lid. That has lowered hand exposure approximately three-fold when compared to our manual placement (both methods tested using ring TLDs and personnel digital dosimeters located at the wrist). Special considerations should be taken to prevent potential airborne and surface contamination, and external radiation exposure to the staff when microwave ovens are utilized for radiopharmaceutical compounding.

Posterboard No. 1512

RADIOCHEMICAL PURITY OF HIGH-ACTIVITY Tc-99m TETROFOSMIN PREPARATIONS: A CLINICAL STUDY. B.F. McKay, A.M. Zimmer and S.M. Spies. Northwestern University Medical Center, Chicago, IL.

Since FDA approval, our department has utilized Tc-99m tetrofosmin for myocardial perfusion imaging. In order to optimize the clinical function in the radiopharmacy, our department has clinically evaluated the radiochemical purity of multiple high-concentration Tc-99m tetrofosmin preparations up to 24 hours after formulation using a rapid miniaturized chromatography system consisting of Whatman Chr 1 strips with ethyl acetate as the mobile phase. Radiopharmaceutical formulation included adding from 300 to 600 mCi of activity, in a dose escalating fashion, to tetrofosmin vials in a total volume of 8 ml. Results of the study demonstrated acceptable radiochemical purity results (greater than 90%) for all radiopharmaceutical preparations, ranging from 300 to 400 mCi, up to 12 hours after formulation. With a concentration of 500 mCi (480-532 mCi), all radiopharmaceutical preparations were acceptable (greater than 90%) up to 8 hours post-formulation. At 10-12 hours after formulation, the purity of 24% (10 of 41) of the preparations were below 90%, but all were above 80%. At a concentration of 600 mCi (577-648 mCi), all preparations were acceptable (greater than 90%) up to 8 hours post-formulation. At 10-12 hours after formulation, the purity of 18% (4 of 22) of the preparations were below 90%, but all were greater than 80%. At 24 hours after formulation, all preparations had radiochemical purities less than 90%, with a range from 60.1% to 89.9%. Results of the study indicate that the radiochemical purity of Tc-99m tetrofosmin is acceptable during routine clinical department use, even when high-activity radiopharmaceutical preparations are formulated.

Posterboard No. 1513

SUPPORT STRUCTURE TO HANDLE INCREASED WEIGHT OF NEW Mo-99 GENERATOR SYSTEM. M.T. Hackett, and J.J. Coupal. Department of Veterans Affairs Medical Center, Lexington, KY.

With the recent development of a new top-loading Mo-99/Tc-99m generator system, special attention should be given to the generator set-up due to the extensive auxiliary shielding. Due to our past experience with a near-disaster involving the use of lead brick shielding around a generator set-up and the cabinet system pulling away from wall mount, we made special preparations prior to the new generator system arrival. We report on these preparations. First we reviewed the specifications of the new system, the one it replaced (side-loading), and another available top-load generator:

	55 GBq Gen. (kg)	Aux. Shield (kg)	Aux. Shield Ht. (cm)	Aux. Shield Wall (cm)
New System	18	144	43	4.5
Old System	16	48	N/A	1.0
Another System	16	63	38	2.0

The new system will reduce radiation exposure to the staff due to the increase in the auxiliary shielding, and additional shielding most likely will not be needed. With this

additional weight, the need for a support unit to handle >160 kg in less than 1000 sq. cm (>350 lbs/sq.ft.) is required. Also, since it is a top-loading, the manufacturer recommends that the support unit be only 61-76 cm (24-30 inches) high. This would lower the potential for arm and back strain during generator placement. Most cabinets or support structures in nuclear medicine would not meet this criteria. We had our engineering service build a steel (64 mm thick) support structure (58 cm high) situated on the floor to support two generator set-ups (side-by-side). This allowed for maximum support and the elimination of having a second support unit for the generator being held for return or used as a back-up. Another possible quick and inexpensive alternative would be the use of cinder blocks on the floor. Though at the time of abstract submission, we have not yet received the new generator due to problems in its production, our structure has supported the two auxiliary shields for over 2 months with no signs of any support problems (e.g., bending or buckling). If one is considering or has this new generator system, careful consideration (or re-evaluation) should be given to the support unit to prevent potential personnel injury from a failing support structure (and generator) or from personnel health (back stain) problems from generator placement.

Posterboard No. 1514

PRECLINICAL PHARMACOLOGY STUDY OF ^{99m}Tc-N-NOEt P. Fang, B.C. Wang, C.Y. Wu, W.X. Wan, X. Zhou, Z.P. Chen. State Key Laboratory of Nuclear Medicine, Wuxi, P.R.China.

^{99m}Tc-N-NOEt [bis(N-ethoxy,N-ethyl dithiocarbamate) nitrido ^{99m}Tc] is a new neutral myocardial imaging agent. We prepared the complex and investigated its pre-clinical pharmacology in animals. Radiochemical purity of ^{99m}Tc-N-NOEt was over than 93% and stable for 6 hours at room temperature. The partition coefficient in octanol and buffer were 434 and 427 at pH 7.0 and 7.4 respectively. Rabbits blood clearance was analyzed with biexponential model and an initial half-time T_{(1/2)α} = 2.5min and a late half-time T_{(1/2)β} = 330min were obtained. ^{99m}Tc-N-NOEt localized selectively in the myocardium of rats, cardiac uptake were 2.79%ID, 2.25%ID and 1.88%ID at 5min, 30min and 90min postinjection, respectively. Images showed pulmonary uptake decreased faster than cardiac uptake in dogs, and the mean heart-to-lung activity ratio were 1.69, 2.40 and 2.55 at 10min, 30min and 60min postinjection, respectively. The heart was distinguishable on scans at 30min, high quality images obtained at 45min, cardiac uptake was 2.82%ID at 90min, but hepatic uptake remained constant. ^{99m}Tc-N-NOEt exhibits favorable stabilities and biological properties. It was worth further studies in humans.

Posterboard No. 1515

EVALUATION OF COLLIMATORS AND FILTER SELECTION EFFECTS ON THE MEASUREMENTS OF CARDIAC FUNCTION WITH ^{99m}Tc-SESTAMIBI GATED SPECT. A.Gagnon, G. Bavaria, R.Taillefer, C.Benjamin. Hôtel-Dieu de Montréal, Canada.

Myocardial perfusion imaging (MPI) performed with Gated SPECT is a widely accepted method to evaluate patients with a known or suspected coronary artery disease. Many camera manufacturers require strict adherence to their gated SPECT imaging protocol for the measurements of cardiac function parameters. Any deviation from the recommended protocol might affect the functional parameters results since they have not been validated. The purpose of this study is to compare the utilisation of different collimators and different filters on the resulting cardiac function parameters and to determine the optimal collimator/filter choice for gated SPECT. Twenty one patients underwent a same day rest/stress ^{99m}Tc-Sestamibi protocol with a 10 and 30 mCi injection sequence. Gated SPECT acquisition was first performed on the stress study using general purpose collimators (GAP), 32 frames over 180°, from LPO to RPO, 16 cycles/frame, 60 seconds/frame with a SMV dual head camera in the 90° configuration. The patient was then reimaged with high resolution collimators (HR) with the same parameters except for the time/frame which was adjusted to take into account the activity decay. Reconstruction was performed using 3 different Butterworth reconstruction filters (cutoff at .6, .45 and .3

Nyquist and power of 5). Ejection fraction (EF), end-diastolic volume (EDV) and end-systolic volume (ESV) were measured using SMV Multidim® program. **Results:**

HR	Cutoff=6	Cutoff=45	Cutoff=30
EF (%)	55 ± 11%	54 ± 12%	58 ± 14%
EDV (ml)	180 ± 57	164 ± 58	130 ± 52
ESV (ml)	86 ± 47	81 ± 48	61 ± 43
GAP			
EF (%)	57 ± 12%	57 ± 15%	59 ± 13%
EDV (ml)	166 ± 53	150 ± 53	123 ± 51
ESV (ml)	76 ± 45	70 ± 46	55 ± 39

There was no clinical relevant differences in the measurements of EF with the different collimator/filter combinations, but the EDV and ESV showed much greater differences when using the various filters. Collimator selection had little effect on EF, EDV and ESV measurements at high cutoff. However a much greater impact was observed at low cutoff for EDV and ESV. ESV and EDV calculation are more likely to be erroneous when using different collimator/filter combinations. Unlike EF, they should be measured using the manufacturer recommended parameters. These preliminary results need to be validated on a larger number of patients.

Posterboard No. 1516

OFF-SITE DETERMINATIONS OF ERPF USING TECHNETIUM-99m MAG3 AND A SINGLE BLOOD SAMPLE METHOD. D. Vinas, P. Denhartog¹, D. Kwan², M. Ichise, Division of Nuclear Medicine, Mount Sinai Hospital, Toronto and ¹Mallinckrodt Medical Inc., Mississauga, Ontario, Canada.

Camera and blood sample methods (BSM's) exist to determine effective renal plasma flow (ERPF) with Tc-99m MAG3. BSM's are more accurate than camera methods. However, BSM's are time consuming requiring laboratory skills. Thus, BSM's may not be suited for all nuclear medicine departments.

The purpose of this study was to evaluate the feasibility of performing ERPF determinations at a remote off-site laboratory.

Blood samples were obtained from 66 patients and ERPF's determined at both an on and off-site facility using an identical BSM (Tauxe et al). After completion of the on-site ERPF, the plasma was resuspended in the original blood sample tube. This was then sent to the off-site laboratory for analysis. A Pearson correlation coefficient and a paired t-test were calculated for the off-site ERPF result against that of the reference on-site. The variability between off and on-site ERPF's was calculated as the absolute value of the difference between the two measurements, expressed as a percentage of the mean value of both measurements. The ERPF results were classified clinically as normal or abnormal based on the nomograms from Tauxe et al. The off-site clinical result was compared to that of the reference on-site for each patient.

The ERPF's for on and off-site determinations were 427 ± 172 (mean ± SD), and 439 ± 177 ml/min, respectively, with a mean difference of 12 ml/min (p < 10⁻⁵). This is within the error of the estimate for the single BSM (19 ml/min). The two ERPF's correlated significantly (ERPF off-site = 1.3472 + 1.0256 x ERPF on-site, r = 0.99, p < 10⁻⁵). The variability was 4.6% ± 3.6. The clinical results indicated 41 patients were normal and 25 abnormal. For each patient on and off-site, all results were matched.

In conclusion, ERPF can be determined accurately off-site by having the patient's blood sample sent out to a remote laboratory. This method would allow many nuclear medicine departments access to the ERPF determination by the more accurate BSM.

Posterboard No. 1517

WHY ARE LATERAL PRONE BREAST VIEWS BETTER THAN ANTERIOR SUPINE IMAGES. D.S.Thakrat, J.B.Cwikla, R.V. Barlow, J.R.Buscombe, A.J.W.Hilson. Royal Free Hospital and School of Medicine, London, UK.

It has been reported, by ourselves and others, that the use of prone lateral views of the breast produce better images of suspected breast cancer than can be obtained in an anterior supine view. The ability to see any particular lesion depends on the eye's ability to contrast activity in the cancer, whether increased or decreased, compared to surrounding normal tissue. In the patient with breast cancer it is the uptake in the tumour compared to normal tissue which is important. The tumour to background ratio (TBR) was determined in 74 breast lesions in 70 women. All women had 10-minute anterior supine and prone lateral images, immediately after injection of 740MBq of Tc-99m sestamibi. Irregular regions of interest

(ROIs) were then drawn around the tumour and surrounding normal tissue and the TBR calculated.

The mean TBR for all lesions in the anterior image was 1.34 and for the lateral prone image the TBR was 1.73 (p < 0.001, paired t test). 10/53 patients with a histologically proven breast cancer had a TBR on the anterior image of < 1.4 making visualisation difficult but a TBR of > 1.4 on prone imaging. This study confirms the clinical finding that better visualisation of breast cancers is possible using prone dependent rather than anterior supine imaging.

Posterboard No. 1518

Simultaneous Quality Control (QC) of both detectors of a dual-head gamma camera using a single close point source.

R. Vandermeiren, A. Dobbelaire, A. Vervae, J. Vandevivere

Aim: QC on dual-head gamma cameras without the facility for tilting the heads is normally performed using flood sources. In daily practice Tc-99m flood sources suffer from the inconvenience of inadequate mixing and possible bulging, Co-57 flood sources are expensive. The point source method was developed in order to gain time, decrease the amount of activity used and exclude possible collimator and flood source irregularities. A method has been described (1) placing a point source on the opposite detector. The acquired image was corrected with a map, taking into account the different geometric path length further away from the centre of field. In order to test the uniformity of both detectors at the same time we placed a point source in the middle of the 2 detectors.

Method: 2 Tc-99m sources were produced: a flood source (925 MBq) and a point source (0.444 MBq) placed in the exact middle of both detectors of a dual-head gamma camera (Trionix BIAD XLT) using a rope hanging from the ceiling. All acquisitions and calculations were performed according NEMA standards. A geometric correction map for the source to crystal distance of 38 cm was mathematically created.

Results: Flood source uniformity with collimator was, until now, 5 times compared with the uncollimated, geometry corrected, point source method and this over a 2 month period. The mean integral uniformity obtained with the flood source (10 data) was 2.20% (S.D. 0.16%). The geometric corrected point source value was 4.05% (S.D. 0.19%). Determination of the centre between both detectors was less critical than expected, variations of 1 to 2 cm are permitted. In order to simulate heterogeneities, off-peak acquisitions were performed. The flood field uniformity went up to 4.88%, whereas the point source uniformity produced values between 9 and 11.5%, probably dependant on the position of the largest inhomogeneity.

Conclusion: Since the single point source method is very sensitive to uniformity variations it can be used for routine uniformity control of dual-head gamma cameras with limited head movement.

1) H.J. Wasserman, Uniformity testing of a dual-head gamma camera with a nearby point source. Nuclear Medicine Communications (1995) 16, 483-488.

Posterboard No. 1519

THE USE OF DYNAMIC ACQUISITION AND CINE VIEWING IN PEDIATRIC NUCLEAR IMAGING. Y.D. Grant. The Children's Hospital, Denver, CO

Nuclear medicine evaluates the function of organs and organ systems. Although these systems are dynamic in nature many make diagnostic evaluations via static imaging alone. We have applied dynamic acquisition parameters and cine viewing to such studies as HIDA scans, GI Bleeding scans, Meckel scans and Cystograms. Cine viewing is used as well in the evaluation of the presence of duplex systems in renal scans.

Methods: Using an ADAC Dual Head Vertex camera images were acquired for 15 sec/image using a 128 x 128 x 16 matrix for the duration of the study. Images were then displayed in cine mode. Images could be filtered using a spatial 5x5 filter to enhance image quality of cine viewing. Images were compressed to 2.5 min/image for film display. **Results:** Examples of cases in which dynamic acquisition and cine

viewing have made the most impact are: 1) GI Bleeding study - Cine viewing allowed for more precise definition of the site of bleeding. 2) Cystography - Cine viewing greatly enhanced the evaluation of low grade vesicoureteric reflux. 3) Renal studies - Cine viewing enabled the radiologist to clearly see the differences in uptake and emptying of the respective poles of a duplex renal system. **Conclusion:** Dynamic acquisition and cine viewing can greatly enhance the diagnostic value of some nuclear imaging procedures in pediatric patients.

Posterboard No. 1520

FACTORS AFFECTING THE HEPATOBILIARY EXCRETION OF Tc-99m MAG3: ITS CLINICAL SIGNIFICANCE IN ROUTINE RENOGRAPHY.

A.Arroyo, B.Burns and P.Patel. St. Vincent Medical Center, and the Medical College of Ohio (MCO), Toledo, Ohio.

OBJECTIVE: Since the release of MAG3 for routine clinical use in 1990 in the US., reports have appeared about hepatobiliary excretion potentially affecting the diagnostic and quantitative information. The aim of this study was to put into perspective the gallbladder (GB) uptake of MAG3 in the clinical setting.

METHODS: Sixty patients with varying degrees of renal impairment were studied. Routine renal function study was followed by an Ant. and Rt.Lat. 3 min. abdominal images. Factors such as: photolytic degradation; reconstitution steps; 99mTc O4 solution, age and concentration; as well as the patient's fasting state were evaluated. The GB uptake was determined as a % of the injected dose.

RESULTS: The MAG3 QC ranged from 90.0% to 99.9% (Sep-Pak method). The %GB uptake ranged from 0.0% (not visualized), to 0.71%. The ERPF ranged from 88 to 743 ml/min. There was no correlation between the QC and the %GB uptake (r=0.12), however careful control of the above mention factors would minimize the formation of impurities and their subsequent hepatobiliary excretion.

CONCLUSION: Our data suggests that GB uptake of MAG3 is minimal, with no adverse effects in the diagnostic and quantitative analysis of renal function. However additional studies perhaps with a right angle detector, throughout the length of the procedure would be needed in order to determine the onset and the course of the GB uptake of MAG3.

Posterboard No. 1521

ENTEROGASTRIC REFLUX MIMICKING GALLBLADDER DISEASE: DETECTION, QUANTITATION AND POTENTIAL SIGNIFICANCE.

A.Arroyo, B.Burns and P.Patel St. Vincent Medical Center, and the Medical College of Ohio (MCO), Toledo, Ohio.

OBJECTIVE: It is not uncommon to visualize enterogastric reflux (EGR) during hepatobiliary imaging (Hbi). It has been shown that reflux of bile may damage the gastric mucosa. It may also alter its function and cause such symptoms as epigastric pain, heartburn, nausea, intermittent vomiting and abdominal fullness. Symptoms also associated with gallbladder (GB) disease. The aim of this study is to quantitate the EGR Index (EGRI) and to determine if a difference exists in normal vs. abnormal response utilizing CCK-augmented Hbi.

METHOD: 130 GB ejection fractions (GBEF) were determined. LAO dynamic data on a 128x128 matrix at a 1 frn/min. rate were obtained. The EGRI(%) was determined by the following formula:

$$EGRI (\%) = \frac{St - So}{Hbo - Hbt} \times 100$$

Where:

So = Stomach activity at time of GB stimulation (CCK).

Hbo = Hepatobiliary activity at time of GB stimulation (CCK).

St = Stomach activity at time t.

Hbt = hepatobiliary activity at time t.

RESULTS: The EGRI was significantly different between normal GBEF (>35%) and those with abnormal EFs, p=0.001. EGR was observed in 76 patients (58.5%), but only 29 patients (22.3%) had significant reflux (EGRI >14.2% at 15 min.). Patients with EGRI ≥24.5±7% accounted for the pathophysiologic syndrome of alkaline reflux or bile gastritis. There was no EGR observed in the remaining 25 patients (19.2%).

CONCLUSION: This simple addition to the CCK-augmented hepatobiliary imaging may detect abnormal % of EGR as the cause of the patient's symptoms in the presence of normal GBEF result, and/or those having risk factors for gastritis or esophagitis.

Posterboard No. 1522

THYROID IMAGING USING PARALLEL HOLE SPECT IMAGING.

A. Gear and D.W. Seldin. Lahey Hitchcock Medical Center, Burlington, MA.

Many Nuclear Medicine departments will soon be faced with the retirement of their last cameras for which pinhole collimators are available. This situation has prompted us to investigate the use of SPECT imaging of the thyroid.

Over the past year, we have performed both pinhole and SPECT thyroid imaging in over 60 patients, using both I-123 and Tc-99m pertechnetate. After the routine pinhole images are obtained (Anterior with marker, Anterior, RAO, LAO), a 15 minutes SPECT scan is performed on a dual-head camera. The acquisition matrix is 128 x 128, with a magnification factor of 3.2. Continuous acquisition over 360° in 3° steps is performed using low energy ultra-high resolution collimators.

Transaxial, coronal, sagittal, and 40 projection raytrace images of the thyroid are created. Interactively rotating 3D surface contour images can also be generated.

Image quality has been good, except in patients with very low uptake in whom planar imaging is also poor. More nodules are seen on SPECT studies than on the pinhole images; in a number of patients CT or ultrasound has confirmed the SPECT findings. Since the pinhole images are acquired for preset counts, the SPECT study may take less time to acquire.

In conclusion, we feel that SPECT thyroid imaging is a viable, easy, and even preferable alternative to pinhole imaging. It allows a department to freely replace planar cameras with SPECT equipment, without losing the department's imaging versatility.

Posterboard No. 1523

EFFECTIVENESS OF IN-VITRO LABELING FOR PRE-CHEMOTHERAPY ASSESSMENT OF VENTRICULAR FUNCTION IN PEDIATRIC ONCOLOGY PATIENTS

MP White, A Russell, DM Cross, DA Clapp, ER Gillan, GV Heller. Hartford Hospital, Connecticut Children's Medical Center, Hartford, CT, University Of Connecticut, Farmington, CT.

Radionuclide ventriculography (RVG) is used to assess ventricular function prior to and during chemotherapy due to the potential cardiotoxic effects of some treatments. Pediatric oncology patients (pts) present unique challenges for technologists as both pts and parents are reluctant to allow additional peripheral intravenous access (IV) when a Hickman catheter (HC) is in place. Previous attempts to label red blood cells (RBC) through HC have resulted in suboptimal or uninterpretable scans due to the high concentration of radiopharmaceutical activity in the catheter. The purpose of this study was to evaluate the in-vitro method for labeling RBC in this limited pediatric population. Ten pts referred for routine RVG prior to chemotherapy were prepped using in-vitro labeling with blood drawn through the HC. Of the ten pts, 2 were being repeated due to poor quality modified in-vitro studies injected through the same HC. Following preparation in accordance with standard instructions the RBC were reinjected through the HC. RVG images were acquired in the standard 3 projections. Studies were evaluated by experienced nuclear cardiologists. All ten studies performed using in-vitro labeling were of superior quality with none requiring repeat visits or additional peripheral IV access.

Conclusion: In-vitro labeling and injection through an existing catheter demonstrates a consistently high binding rate. This may be ideal for use in pediatric oncology patients with Hickman catheters in preventing the necessity for further traumatic intravenous access.

Posterboard No. 1524

EVALUATION OF NEW ADAC VERTEX COLLIMATOR FOR TC-99M SPECT MYOCARDIAL PERFUSION IMAGING

A Russell, MP White, DM Cross, AT Fossatti, MG Levine, CC McGill, GV Heller. Hartford Hospital, Hartford, CT, University of Connecticut, Farmington, CT

ADAC Corporation has developed new cardiac high resolution collimators (CDHR) for the Vertex dual-head camera system. Customers reported decreases in sensitivity when using the standard high resolution collimators (VXHR) for both cardiac and general nuclear medicine procedures. The aim of this study was to evaluate image quality and count statistics for the CDHR collimators by comparing acquisitions to the VXHR using the same patients (pts). Nine pts referred for routine rest/stress SPECT myocardial perfusion imaging (MPI) and who were able to tolerate two additional acquisitions were asked to participate. Pts were injected with Tc-99m Sestamibi at rest and at peak stress. Standard imaging was performed on the Vertex using identical acquisition parameters for each collimator. Counts/pixel were calculated using a 6 pixel region of interest (ROI) placed over the same area of the myocardium for each data set. Image quality was assessed blinded by three experienced nuclear cardiologists using a 5 point scale. (1=Poor, 5=Excellent) Agreement was by consensus. Count/pixel comparison showed a good correlation for both stress ($r = 0.91$, $p = NS$) and rest images ($r = 0.85$, $p = NS$). Image quality was identical for all 9 pts.

Conclusion: The CDHR collimators demonstrated a good correlation in counts/pixel when compared to the VXHR collimators and image quality was the same.

Posterboard No. 1525

Frame Loss Artifacts in Myocardial Perfusion SPECT Imaging: The Difference Between Single- and Dual-Headed Systems. Gretchen E. Rose Wolf. Department of Nuclear Medicine, Harborview Medical Center, Seattle, Washington.

Right-angle dual-headed tomography has increased cardiac SPECT utility by cutting acquisition time in half which enhances gating capabilities. When gating, however, a deceleration in heart rate due to a return to baseline rate after stress or lessened anxiety at the end of a study may significantly impact the last step(s) of a gated study with possible frame or information loss. The purpose of this study was to illustrate the artifacts produced in myocardial perfusion studies when a frame or frames are lost in single- and dual-detector SPECT imaging methodologies. **Methods:** A near normal Tc-99m Sestamibi study was obtained using a dual-headed camera system fitted with high-resolution, long-bore collimators. The normal study was processed including all frames (1-32). Then to demonstrate the effect of losing frames on a dual-headed system, at the end of acquisition, the near normal study was processed three different ways to simulate frame loss. The three studies processed included a study in which frames 16 and 32 were removed; a second study in which frames 15, 16, 31, and 32 were removed; and a third study in which frames 13-16 and 29-32 were removed. The results of these studies were then compared to the same study design on a single-headed system, in which frames were lost at the end of the study. Three studies were processed according to the single-headed system protocol. The first study simulated losing only one frame (frame 32). The second study simulated losing two frames (frames 31 and 32), and the third simulated losing four frames (frames 29-32). All images were visually interpreted for analysis. **Results:** Loss of frames at the end of a SPECT acquisition results in significant inferoseptal wall defects, left ventricular lumen narrowing, as well as thinning of the anterior and lateral walls. The overall appearance of the heart is a more oval-shaped heart with decreased perfusion. The effect of losing the last frame in a dual-headed camera system as opposed to losing the last frame in a single-headed camera system is more substantial. In a dual-headed system, when a frame or a step in the rotation is lost, two frames are lost. For example, when the last frame is cut off in a myocardial perfusion study with two detectors, both frame 16 and 32 are lost, whereas, in the same situation during a single-headed acquisition only frame 32 is lost. **Conclusions:** A scan resulting in the loss of a frame in either a single- or a dual-headed camera system creates artifacts in the myocardial wall and should always be repeated. It is significant to note that artifacts present in a dual-headed system are much more prevalent than in a single-headed system due to the nature of dual-headed acquisition parameters.

Posterboard No. 1526

RETROSPECTIVE ANALYSIS OF TUMOR SIZE IN PATIENTS WITH KNOWN PRIMARY COLORECTAL CANCER HAVING PET SCANS WITH F-18 FLUORO-DEOXY-GLUCOSE (FDG). V. Cronin, P. Galantowicz, J. Gona, H. Nabi, Center for Positron Emission Tomography, VA Western New York Healthcare System, Buffalo, NY and the Department of Nuclear Medicine, State University of New York at Buffalo, NY

The ability to accurately measure the size of the tumor from a PET scan would

be valuable for clinical staging and therapy planning. The purpose of this study is to compare predicted tumor size (PTS) obtained with PET to actual tumor size (ATS) obtained from resected surgical specimens.

Twenty patients were injected with <10 millicuries of F18 FDG and scanned forty minutes post injection. Transmission scans were obtained for 6 min/bed position and emission scans for 8 min/bed position. The images were reconstructed with a Hann filter and a cutoff of 0.3 on a zoom of 1.5. All patients went on to surgery with confirmed pathology of the tumor.

Each tumor was measured in three dimensions (length, width and depth), in centimeters (cm) using the Whole Body Viewer and Image Tool programs, without knowledge of the pathology reports. Tumor measurements and calculated volumes (all in cm) were compared to the actual size of the resected tumor.

Results: All volume measurements taken from the computer overestimated the size of the tumor, with cecal tumors the largest in error. The error was the smallest in tumors in the 3-15cm range. The difference between true and observed were as follows: length = 0.9 ± 1.0 , depth = 1.3 ± 1.3 and width = 1.4 ± 1.2 . The length of the tumor was most accurate using Whole Body Viewer. The p number was calculated for all three and found not to be significant. When analyzing the size of the tumor, error was highest in tumors < 3cm which were difficult to draw. Tumors larger than 15cm³, affected by burn out, were also associated with a large error.

Estimating the size of the tumor was most accurately done in Whole Body Viewer with tumors in the 3-15cm range. However, the size of the tumor was overestimated in all cases when volumes were calculated multiplying the length x depth x width. Measurements can be useful to the physician keeping in mind that individual dimensions are more accurate from the PET scan than the calculated overall volumes which exaggerate the individual errors.

Posterboard No. 1527

THE 3RD FOOT SIGN: AN ARTIFACT OCCURRING IN SIMULTANEOUS DUAL ISOTOPE ACQUISITIONS. M.O. Afriyic, F. Leveque, R. Johnson, C. Gonzalez, M.B. Tomas, C.J. Palestro. Long Island Jewish Medical Center, New Hyde Park, NY.

Simultaneous dual isotope acquisitions (DIA) provide important information about the spatial distribution of the 2 tracers being imaged; information which may not be appreciated by merely viewing images of each tracer side by side. This technique is especially useful for imaging feet, where nuclear medicine is often used to determine whether a focus of infection is confined to soft tissues or involves bone: osteomyelitis. The additional information DIA provides is not without its price, however; meticulous technique is necessary if diagnostically useful information is to be obtained. When performing DIA of the feet with In-111-labeled leukocytes & Tc-99m MDP or sulfur colloid, we have observed the appearance of a "3rd foot" in the upper (247 keV photopeak) window image of In-111 which prompted this investigation. We set up our gamma camera system, as we routinely do for patients, using a medium energy collimator, a 128x128x16 matrix & 3 separate windows: 15% centered on the 140 keV Tc-99m photopeak 5% centered on the In-111 174 keV photopeak, & 20% centered on the In-111 247 keV photopeak. We placed 2 3.7 MBq Tc-99m sources equidistant from the center of the field of view, to simulate the feet. We acquired data for 1 min, & then added an additional 3.7 MBq Tc-99m to each source & performed another acquisition. We repeated this until an image appeared in the In-111 247 keV window, which occurred when the source strength reached 18.5 MBq each, or a count rate, in this window, of 2.8 kcps. Varying the distance of the sources by moving them closer to or further away from the center of the field of view did not eliminate the artifact. Placing one source on top of the other (with a total activity of 37 MBq) did eliminate it as did reducing window width to 10%. The likely explanation for this phenomenon is simultaneous or coincidental interaction of 2 Tc-99m scatter events ($\leq 90^\circ$) with the crystal which are interpreted by the system as a single event, occurring between the 2 actual events. Because this phenomenon is observed at a window width of 15%, but not 10%, the scatter event must have a photopeak of 228-235 keV or 259-266 keV. This artifact can be eliminated by reducing the upper peak In-111 window to 10%, decreasing amount of Tc-99m tracer injected, and/or increasing time between injection & imaging.

Posterboard No. 1528

CLINICAL UTILITY OF MONITORING THE PRODUCTION OF F-18 FLUOROXYGLUCOSE BY AN AUTOMATED SYNTHESIS UNIT. T. Burris, D. Polulak, L. Eshima, M. Goodman and D. Eshima. Emory University, Center for Positron Emission Tomography, Atlanta GA.

The granting of an NDA for F-18 fludeoxyglucose, (FDG) is expected to increase its clinical demand. However, its widespread use is dependant in part upon reimbursement issues and a reliable supply of the

radiopharmaceutical agent. After production of F-18 fluoride from the cyclotron, the activity is delivered to an automated synthesis unit for the production of FDG. Emory University has an RDS 112 Cyclotron with a silver target which delivers the fluoride to an automated synthesis unit or CPCU. A major limitation with the CPCU is the inability to identify synthesis problems which occur during the reaction process. In order to minimize problems associated with the automated synthesis unit, we routinely calibrate and clean our CPCU's, in addition we have installed a microboard camera which is controlled by a computer into our CPCU's. Several problems have been observed during the routine synthesis with the most common failures observed being associated with the addition of reaction components, transfer of fluids, bubbler rates and bath positioning. Monitoring the water evaporation times has indicated that it is necessary to routinely make minor changes in the drying time to get adequate drying of the fluoride. Transfer of fluids is sporadic and frequently transfer times need to be adjusted. In addition, sporadic failures to add one of the reaction solutions has been observed and has indicated a severe malfunction in the box requiring immediate repair. A failure in any part of the synthesis reaction may adversely impact on the production of FDG and the problems we have observed have been random. It has been possible to salvage the synthesis by aborting the automated synthesis program and running the remaining reaction steps sequentially; however in the future, in compliance with cGMP we may not be able to interrupt the automated production. However the ability to watch a run may allow us to more easily trouble shoot the CPCU and it may be useful for FDA documentation.

Posterboard No. 1529

STABILITY OF FILTERED Tc-99m SULFUR COLLOID FOR LYMPHOSCINTIGRAPHY STUDIES. P. Corrigan, L Eshima and D Eshima. Department of Radiology, Emory University Hospital, Atlanta, GA.

There has been a resurgence in lymphoscintigraphy studies to identify lymphatic drainage pathways and for localizing the sentinel node. Tc-99m antimony trisulfide colloid was originally developed for this study. However, the agent was never commercially available and modifications of Tc-99m sulfur colloid (Tc-SC) have been utilized. In this study we wanted to determine the stability of a modified Tc-SC preparation after filtration. We prepared the Tc-SC utilizing our published procedure (JNM 37;1575-1578), 155 ± 11 mCi of pertechnetate in 3 mls was added to the sulfur colloid vial, the vial was heated for 3 minutes in a rolling water bath, allowed to cool for 2 minutes and then neutralized. The initial radiochemical purity was found to be 96.4%. The Tc-SC was then filtered through a 0.22µ Millipore filter into 3 mL syringes and allowed to stand. At 0.5, 1, 2, 4 and 6 hours post filtration, samples were evaluated for activity retained in the syringe and for radiochemical purity utilizing ITLC-SG paper as the stationary phase and 0.9% NaCl and methyl ethyl ketone (MEK) as the mobile phase.

Summary of Results	0.5 hr	1 hr	2 hr	4 hr	6 hr
% Labeled (NS)	83%	80%	87%	82%	85%
% Labeled (MEK)	86%	87%	87%	85%	88%
% Syringe Retention	9%	11%	13%	12%	12%

These results show that following filtration there is a significantly lower radiochemical purity which did not change over a 6 hour period. There is also approximately a 12% loss in the total available activity in the syringe due to syringe retention. In conclusion, it should be possible for a filtered Tc-SC preparation to be distributed from a centralized radiopharmacy thereby increasing the widespread availability of this clinical procedure.

Posterboard No. 1530

INITIAL TECHNICAL EXPERIENCE IN COINCIDENCE IMAGING OF F-18 FDG USING A DUAL-HEAD SCINTILLATION CAMERA M.D. Shone, L.K. Eastman, J.A. Patton, and M. P. Sandler. Vanderbilt University Medical Center, Nashville, TN.

The purpose of this work is to report the initial technical experiences with coincidence imaging of positron emitters using a clinical SPECT system

(Elscint VariCam). Imaging was accomplished using slit collimators of 1 cm spacing to reduce the effects of scattered radiation and single events, with 4 PHA windows per detector used to monitor the photopeak and scatter distributions. Image acquisition is similar to SPECT except data are recorded (in list mode) only if two events are detected within 10 nanoseconds of each other in the two detector heads. Patient setup is easier than in SPECT since the region of interest is simply centered in the field-of-view and a constant fixed distance between detectors is maintained in all studies. Data collection is accomplished using continuous acquisition. Image processing is a two step process. First the list mode data are rebinned into 60 planar projection images with the options for defining coincidences as high resolution (using only photopeak data from each detector), normal resolution and sensitivity (using photopeak data from one detector and photopeak or scatter data from the second), or high sensitivity (using photopeak or scatter data from each detector). Filtered back projection techniques are then used to generate the final images. Twenty-one patients have been imaged (7 brains and 14 tumors) at 0.5 to 4 hours after administration of 10 mCi of (F-18) FDG using an acquisition time of 30 minutes and all images were of good to excellent quality. Overall, coincidence imaging has proven to be no more difficult or time consuming than SPECT imaging. When equipment and protocols are established, coincidence imaging may become as routine and commonplace as SPECT imaging is in nuclear medicine.

Posterboard No. 1531

COMPARISON OF Tl-201 AND Tc-99m MIBI BRAIN SPECT IMAGING AGENTS IN PATIENTS WITH GLIOMA. J. Patel, S. Kim, J. Zhang and C. Intenzo. Thomas Jefferson University Hospital, Philadelphia, PA

Tc-99m-MIBI has been utilized for tumor imaging to differentiate benign vs. malignant recurrent tumors. The objective of this study investigates the efficacy of Tc-MIBI brain SPECT in detecting patients with supratentorial recurrent brain tumors. Comparison was made with Tl-201 brain SPECT.

Thirty-five patients with known history of supratentorial gliomas were evaluated sequentially with 3 mCi of Tl-201 and 20 mCi of Tc-MIBI. The brain SPECT was obtained for the evaluation of recurrent brain tumor as a part of surveillance protocol. There were 13 patients with low grade glioma, 9 patients with anaplastic and 13 patients with glioblastoma multiforme. The maximum tumor uptake index was obtained. SPECT findings were correlated with clinical outcome as stable or recurrent defined by the surgical resection or clinical follow-up.

Mean Tc-MIBI tumor index in stable tumor was 3.12±0.77, whereas Tc-MIBI tumor index in recurrent brain tumor was 6.67±1.3. The sensitivity and specificity of Tc-MIBI brain SPECT in detecting recurrent brain tumor was 73% and 81%. Mean Tl-201 tumor index of stable tumor was 1.5±0.41 and in the recurrent tumor was 3.65±2.2. The sensitivity and specificity of Tl-201 was 92% and 89% respectively. False negative Tc-MIBI brain SPECT was seen in a patient with multidrug resistance.

The efficacy of Tc-99m-MIBI brain SPECT in detecting recurrent brain tumor is less desirable than the Tl-201 brain SPECT. One should be cautious in interpreting negative Tc-MIBI brain SPECT in malignant brain tumor, since negative Tc-MIBI brain SPECT does not rule out the absence of recurrent brain tumor.

Posterboard No. 1532

How Valid are DEXA Spine Bone Mineral Density Measurements in Elderly Patients? S.F. Grant, T.W. Larsen, R.W. Gwilliam II, J.R. Galt, R.K. Halkar, and N.P. Alazraki, VAMC (Atlanta), Decatur, Georgia.

Degenerative joint disease (DJD) and compression fractures (CF), frequent conditions in the elderly population, falsely elevate spine bone mineral density (BMD) measurements with DEXA. The purpose of our study was to assess how often DJD and CF affected BMD assessment and their relation to age of the patient.

Vertebral (L1 to L4) and femoral neck BMDs were measured in 80 consecutive patients (age: 40-79 years, M/F=70/10) using a Hologic QDR-4500C fan beam bone densitometer. Our criteria for DJD and CF affecting spinal BMD were an intervertebral "T value" (BMD compared to normal peak bone mass) variation of more than one standard deviation. Using this criterion we analyzed the incidence of DJD and CF for various age groups.

In 35 of 80 patients, spinal BMD "T value" showed more than one standard deviation intervertebral variation suggesting that it was spuriously altered by DJD or CF. Analysis according to age group is as follows:

AGE	No DJD	DJD	Total
40-49	12	6	18
50-59	10	5	15
60-69	10	5	15
70-79	13	19	32
Total	45	35	80

The DJD and CF effect is significantly higher (Chi Square $P < 0.05$) for the 70-79 year age group than the younger age groups.

In conclusion DJD and CF may significantly affect spine BMD measurements in older patients. In this group BMD measurements of the femoral neck may be more reliable.

Posterboard No. 1533

DYNAMIC XE-133 BRAIN SPECT ON A TRIPLE-HEADED GAMMA CAMERA. K. Stein, K. Tatsch, K. Hahn. Department of Nuclear Medicine, Ludwig-Maximilians-University of Munich, Munich, Germany

Detection of regional perfusion abnormalities and quantitative measurement of vascular reserve capacity are important in patients with cerebrovascular disorders. Thus, there is a necessity for imaging modalities which provide this information and are available for routine use.

Xe-133 is an inert and diffusible gas for quantitative measurement of regional cerebral blood flow (rCBF). The rapid clearance of the tracer from the brain requires special SPECT systems with high sensitivity and rapid acquisition cycles.

We implemented the measurement of rCBF before and after provocation with a carbonic anhydrase inhibitor (acetazolamide) on a commercially available triple-headed gamma camera (Prism3000, Picker Int.). Spatial resolution of the system is 15 mm FWHM, temporal resolution is 10s. Subjects connected with a Xenon inhalation unit (Simonsen, Denmark) are studied with their eyes and ears open in a dimly lit environment. Arterial input function is monitored with a CdTe detector placed over the right upper quadrant of the lung. The acquisition consists of 2 stages. In the first stage background information for both the brain and the lung is obtained (360°, 6° intervals, 1.5s/projection, 64 x 64). During the second stage subjects are administered 7.4 - 11.1 GBq/l (20-30 mCi/l) of Xe-133 in air for 1 min., followed by a 6 min. washout period (360°, 6° intervals, 0.5s/projection, 64 x 64). After examination of the lung curve transverse slices are reconstructed (filtered back projection, ramp filter). Using Kanno-Lassen and/or Convolution algorithms rCBF is calculated in ml/min/100g brain tissue. After filtering and reformatting the generated perfusion map may be displayed in transverse, sagittal and coronal slices. In contrast to older dedicated brain systems dynamic SPECT on an available triple-headed gamma camera yields full-volume instead of single slice images representing rCBF quantitatively with improved spatial resolution.

Posterboard No. 1534

BREMSSTRAHLUNG IMAGING OF Y-90 MONOCLONAL ANTIBODY: EFFECT OF IMAGE RESTORATION. M. Whatley, C. Barker, J. White, T. Waldmann, L. Top and J.A. Carrasquillo. National Institutes of Health, Bethesda, Md.

Although Y-90 has many optimal features as a therapeutic radionuclide its lack of gamma rays makes imaging difficult. Previous phantom studies have evaluated the use of Wiener filter for image restoration but no patient studies with Y-90 imaging were included. In this study the effect of post-acquisition Wiener filtering images obtained from bremsstrahlung radiation was evaluated. Patients undergoing radioimmunotherapy using Y-90 anti-Tac, an antibody directed against the alpha subunit of the IL-2 receptor were imaged. Patients were imaged at various times following intravenous administration of 5 to 15 mCi of Y-90 anti-Tac. Images were acquired using a 90% window centered at 81 keV. We used either high energy or medium energy collimators and images were acquired in 256x256 matrices for 5-15 min per image. The counts per minute per 5 mCi administered ranged from 4476 cpm to 13392 cpm (mean of 9756

cpm) for a typical torso view (n=6) using the medium energy collimator. The torso images acquired using a high energy collimator (n=3) had from 1684 cpm to 3384 cpm with a mean of 2377 cpm. Two patients were studied with both the medium energy and high energy collimators. The sensitivity of the high energy collimator was 72% lower than that of the medium energy collimator. Selected images were processed using a two-dimensional Wiener restoration filter. Camera response functions were obtained for both high and medium energy collimators using a point source of Y-90 located in the center of a water-filled elliptical phantom. The phantom dimensions of 20 cm by 30 cm approximate an average patient imaging geometry. The raw images had lack of clear borders. Although gross structures such as blood pool and liver could be identified smaller areas of tumor uptake were not clearly visualized in the raw images. The processed images visually appeared easier to read and questionable areas of uptake were more easily identified. A review of In-111 anti-Tac images performed 6 weeks before or after Y-90 therapy allowed comparison to Y-90 images. The differences in image quality were best appreciated in areas with high Y-90 uptake such as the blood pool and liver. While the processed images had sharper borders and better contrast than the raw data, the image quality did not approach that seen with In-111 images. Images were often noisy which made interpretation of some areas difficult. In conclusion post processing of Y-90 bremsstrahlung images using a Wiener restoration filter improves visual assessment of images although image quality is much poorer than that of In-111.

Posterboard No. 1535

Technegas: Reduced radioactive contamination levels and improved delivery using an occlusive face mask.

P.J. Tually, Dept. Nuclear Medicine, Concord Hospital, Sydney Australia.

Effective administration of Technegas is highly dependant on patient compliance. Throughout the breathing process, the patient should retain a firm seal over the mouthpiece to maximise the volume of Technegas entering the lungs and to effectively filter the expired air. With a nose clip in situ, the patient should inhale the agent, hold their breath for 2-3 seconds and exhale. This process is then repeated until a desired count rate of 2500-3500K sec⁻¹ has been achieved.

Patients undergoing ventilation studies are quite often dyspnoic, distressed and elderly. The administration process can be difficult and as a result the agent does not penetrate the lung periphery properly. Poor compliance may cause the exhaled Technegas to escape the mouthpiece and filter resulting in radiation contamination to the patient, technologist and equipment.

An alternative method utilising a full face occlusive mask with a rubber seal has been implemented to assist in administering Technegas to problematic patients. The use of this mask increases the efficiency of delivery by providing a superior seal encompassing the nose and the mouth. This is more comfortable for the patient than the standard mouthpiece and as the nose is covered by the mask, problems with nasal occlusion are avoided. This results in greatly improved compliance as there is no opportunity to breathe other than via the delivery system. Improved compliance means an easier, faster administration and less chance of contamination.

A secondary gas inlet line is available on the mask for the administration of oxygen. These masks are typical of those available at many institutions and the additional cost is low if they are recycled through a central sterilizing facility.

The use of a mask rather than a mouthpiece results in improved compliance, greater patient comfort and acceptance, superior images and lower contamination.

Posterboard No. 1536

IMAGE COREGISTRATION AND SUBTRACTION TECHNIQUE FOR COMPARISON OF SERIAL FDG PET BRAIN TUMOR IMAGING. R.L. Fain, and G.D. Hutchins. Indiana University Medical Center, Indianapolis, IN.

The objective of this study was to evaluate the use of standard image coregistration and subtraction software as a tool for evaluation of disease progression in FDG PET brain imaging studies of brain tumors. Two patients with serial FDG studies were examined. One of these patients had 4 PET studies over a 2 year period and the other had 6 studies over a 3 year period.

In the first patient, the subtraction images between the 1st and 2nd studies reveal a significant area of tumor growth. Between the 2nd and 3rd show tumor necrosis and further growth in a new area. The last set show resection and finally residual tumor rim. In the second patient, the 1st, 2nd and 3rd sets of data show no change. Between the 3rd and 4th, there is significant tumor growth. The Subtraction between studies 4 and 5 shows Necrosis, and possible re-growth in the original location.

Displaying the images with standard 3-view display software facilitates simple representations of tumor change over time. Special overlay programs can be used to show the subtraction image on top of the raw image sets.

This preliminary study demonstrates that image 'coregistration and subtraction software can be helpful in the evaluation of disease progression in patients with brain tumors.

Posterboard No. 1537

IMAGE COREGISTRATION AND SUBTRACTION TECHNIQUE FOR COMPARISON OF INTERICTAL AND ICTAL HMPAO SPECT STUDIES. R.L. Fain, G.D. Hutchins, and O. Markand. Indiana University Medical Center, Indianapolis, IN.

Evaluation of Brain SPECT images is done primarily with visual interpretation only. Visual interpretation and comparison between Interictal and Ictal image sets is at best difficult. To enhance the image data available for interpretation, co-registration and image subtraction of Ictal - Interictal studies has been demonstrated to be helpful in determining seizure foci.

Software developed in-house allows us to three dimensionally co-register the Single Photon Emission Computed Tomography (SPECT) studies from the same patient. Normalization and subsequent subtraction of the interictal and ictal image sets create an overlay data set which shows the most likely area of seizure focus. Displaying the images with standard 3-view display software facilitates simple representations of Seizure focus. Special overlay programs can be used to show the subtraction image on top of the raw image sets. A total of 10 subjects have been studied using this technique. Initial data shows agreement between SPECT subtractions and Interictal PET Imaging in 4 out of 10 subjects. Further processing and method improvement will likely increase the overall correlation.

The co-registration and subtraction of these studies may represent a useful technique to groups who need to evaluate and compare Interictal and Ictal SPECT studies. Especially those without multiple correlative imaging modalities available.

Posterboard No. 1538

TECHNICAL ASPECTS OF AN OUTREACH MOBILE NUCLEAR MEDICINE SERVICE. T.P. Owens, J. C. Hung, R.B. Glynn, B.P. Mullan and D.L. Johnston. Mayo Clinic, Rochester, MN.

Several of Mayo Clinic's affiliated outreach sites had the need for nuclear medicine studies, but did not have the volume to justify starting their own department. This need prompted Mayo Clinic to create its own mobile nuclear medicine service. The purpose of this abstract is to describe the development and implementation of an efficient mobile nuclear medicine service with the capability of offering same day reports. Mayo Clinic's mobile nuclear medicine service began January 20, 1995, to five sites in southern Minnesota and northern Iowa. Five sites are visited once per week and vary from 40 to 90 miles from Rochester, MN. We have the ability to do most general nuclear medicine studies, SPECT cardiac perfusion studies, and resting gated blood-pool imaging. Special studies such as pharmacologic stress testing, gallbladder ejection fraction with CCK, and Captopril renal scans were available. Class B commercial driver's license with hazardous material endorsement was required by the nuclear medicine technologist driving the truck. Thirty hours of radiation safety training were needed for Nuclear Regulatory Commission and Department of Transportation requirements for transporting radioactive materials and using them at other facilities. Days for the technologist on the mobile unit start at 5:30-6:00 a.m. with a pre-trip inspection of the 36-ft truck. Radiopharmaceuticals are then picked up at our main nuclear pharmacy where shipping papers are created for transportation to the outreach site. Driving to the sites takes 1-2 hr depending on the road conditions. Connecting to the electrical, phone and modem lines, quality control of the Siemens Orbiter single-head SPECT camera, constancy test of the dose calibrator, and leveling the truck takes 30 min. The mobile unit has a Medasys Pinnacle computer for acquiring the studies and a Gateway 2000 computer to modem studies back to Mayo Clinic. A Helios Dry Film Laser printer is used to produce hard films to be read by the radiologist at the outreach site for general

nuclear medicine studies. Cardiac studies are read at Mayo Clinic and a same-day report is faxed to the outreach site. In the first 23 months, a total of 1,146 studies were completed: 778 cardiac (68%) and 368 general studies (32%). The presentation will further explain the aspects that we feel make our mobile nuclear medicine service efficient and cost effective. This may serve as a template that other facilities can use for the establishment of their own mobile nuclear medicine service.

Posterboard No. 1539

DISTRIBUTION OF CELL-BOUND ACTIVITY OF STABILIZED Tc-99m-EXAMETAZIME-LABELED LEUKOCYTES. J.C. Hung and S. Chowdhury. Mayo Clinic, Rochester, MN.

The standard gravity sedimentation method in harvesting leukocytes yields a mixed cell population with significant red blood cell (RBC) and platelet contamination. According to our previous study on leukocyte preparations labeled with In-111-oxine and Tc-99m-exametazime, ~20% activity is associated with both the RBC and platelet portions and only about half of the activity is tagged to the granulocytes. Although there is ~18% activity in the plasma with In-111-oxine-labeled leukocytes, only ~3% activity is found in the plasma with Tc-99m-exametazime-labeled leukocytes. With the use of stability agent (*i.e.*, methylene blue and sodium phosphate buffer mixture), the *in vitro* stability of Tc-99m-exametazime has recently increased from 30 min to 4-6 hr post reconstitution. Using double washing technique, we have shown that stabilized Tc-99m-exametazime can be used effectively for leukocyte radiolabeling. The purpose of this study was to compare the distribution of cell-bound activity of radiolabeled leukocytes using 0.5 ml stabilized Tc-99m-exametazime (~925 MBq, 62.5 µg exametazime). Ficoll-Hypaque technique was used to separate the various blood components in the Tc-99m-exametazime-labeled leukocyte suspension (labeling efficiency = $83.8 \pm 0.6\%$) ($n = 3$). The results of the distribution of Tc-99m-exametazime activities in RBC, platelets, granulocytes, and plasma were 7.1 ± 2.0 , 17.8 ± 1.8 , 73.1 ± 1.4 , and $2.1 \pm 0.3\%$, respectively ($n = 3$). Although plasma-associated activity remained low with the stabilized Tc-99m-exametazime-labeled leukocytes, the activity in RBC contamination was only $7.1 \pm 2.0\%$ and a significant portion of the activity (*i.e.*, $73.1 \pm 1.4\%$) was tagged to the stabilized Tc-99m-exametazime. This suggests that plasma may be used to incubate and wash the isolated leukocytes to improve the viability of the cells when stabilized Tc-99m-exametazime is used to radiolabel the leukocytes.

Posterboard No. 1540

Routine Gamma Camera Imaging With 15.9 mm (5/8") NaI (TI) Crystals, J.R. Krzos, J.R. Halama, R.E. Henkin, Loyola University Medical Center, Maywood, IL; M.W. Groch, Northwestern University, Chicago, IL

With the development of coincidence imaging on gamma camera systems, manufacturers have installed thicker crystals to increase the sensitivity for 511 KeV photons from positron emitting isotopes. Although it is well known that the intrinsic resolution decreases with thicker crystals, digital processing of signals beginning at the photomultiplier tube of the current digital gamma cameras has minimized the resolution loss to less than 0.5 mm. It is questionable whether this loss is clinically significant when using standard collimators for imaging. We evaluated the Vertex Epic Plus Dual Head Gamma Camera manufactured by ADAC Laboratories, Milpitas, CA, that has been upgraded to a 15.9 mm (5/8") thick crystal for coincidence imaging, for routine clinical imaging. System sensitivity and resolution measurements and patient studies were compared to a similar system that has a 9.5 mm (3/8") thick crystal. The manufacturer specifies an intrinsic resolution for Tc-99m of 3.5 mm FWHM for 9.5 mm crystal and 3.9 mm FWHM for 15.9 mm crystal. Imaging a line source at a distance of 10 cm with a low-energy high-resolution collimator demonstrated no significant difference (within 2 mm of the published resolution of 7.4 mm FWHM for each measurement) in system resolution between the two systems. Similarly, there was no significant difference in resolution for Tl-201. Likewise, there were no significant differences in system resolution when imaging line sources of Ga-67 and In-111 at 10 cm with a medium-energy collimator. The system sensitivity for Tc-99m was 5% greater on the 15.9 mm crystal. There were no observed differences, however, in the sensitivity between the systems for Tl-201 and Ga-67. For patient images, there were no observed differences in sensitivity and the overall quality of the studies. We conclude that the upgrade to a thicker crystal in a digital gamma camera system required for coincidence imaging yields patient images of the same resolution and quality with some increase in sensitivity across the spectrum of radioisotopes used clinically in nuclear medicine.

STUDENT DAY ORAL SESSION

Tuesday, June 3, 1997

Session 208

12:30-2:00 p.m.

Room: 206

No. 1600

OPTIMIZATION OF PLATELET RADIOLABELING USING ^{99m}Tc -TECHNETIUM-HMPAO. T. Navaratnam, M.M. Dalipaj, A. Jansson, T. Alvarez-Diez, and T.D. Ruddy. University of Ottawa Heart Institute at the Civic Hospital, Ottawa, Ontario, Canada.

Labeled platelets are used for diagnosis of thrombus. Previous studies modified factors such as incubation temperature, incubation volume, incubation medium and incubation time to reach good radiolabeling efficiency.

Purpose: To optimize the method of radiolabeling platelets with ^{99m}Tc -hexamethyl propylene amine oxime (HMPAO).

Methods: A total of 42 blood samples were taken from 18 volunteers. The platelets were separated and radiolabeled with ^{99m}Tc -HMPAO using various parameters. We focused on modifying the number of spins, centrifugation time, centrifugation speed, ACD to blood ratio and also incubation temperature.

Results: Samples that were spun with the 3-spin versus 2-spin method resulted in a better radiolabeling efficiency (55.6% and 50.4%, p value=0.045) and the least amount of WBC contamination (3-spin=0.3% and 2-spin=1.7%). The isolation of platelets was achieved efficiently using a centrifugation speed of 1800 rpm. Incubation temperature did not change the radiolabeling efficiency. However, the stability of the label at 24hrs was better with samples incubated at 22°C versus 37°C (87.3% and 76.3%, p value=0.01).

Conclusion: Platelets labeled with ^{99m}Tc -HMPAO according to our optimized method (3-spin, 22°C) can achieve an average labeling efficiency of 55.6%.

No. 1601

A COMPARISON BETWEEN THE PERCENTAGE OF LEFT VENTRICULAR DEFECTED MASS (LVDM) AND THE LEFT VENTRICLE EJECTION FRACTION (LVEF) IN PATIENTS WITH MYOCARDIAL INFARCTION (MI). K. Nguyen, H.L. Pham, F. Mishkin. Harbor- UCLA Medical Center, Torrance, CA.

The early diagnosis of MI is important for the prognosis of cardiac patients and sometimes, it furnishes vital informations. Angiography is the most accurate way of detecting MI, providing information concerning coronary artery anatomy and wall motion of the heart, but it is also very invasive. Therefore, a non-invasive, yet accurate way of rapidly quantify MI may be helpful. The purpose of this study is to compare the relationship between the percentage of LVDM and LVEF.

Twenty-nine patients with MI, age 40-72 years old, with both myocardial perfusion and ejection fraction studies were randomly selected. They received 555 MBq Tc-99m Sestamibi at peak treadmill exercise or following IV Persantine. A twenty minute SPECT acquisition was acquired one hour post injection in supine position (and prone if necessary) collecting 30 frames of 40 seconds each. At rest, patients received 555 MBq Tc-99m Sestamibi using a bolus technique to acquire right anterior oblique data followed by tomographic acquisition. Thirty seconds List mode data for the first pass transit were acquired into an on-line computer. Standard computer programs were used to calculate the LVDM from tomographic data and LVEF from List mode data. Data was collected, plotted and analyzed correlation between LVDM and LVEF. The result shows an excellent correlation with $r = - 0.93$. We conclude that the LVDM is inversely proportional to the LVEF.

STUDENT POSTER SESSION

Session 209

Posterboard No. 1602

COMPARISON OF TWO MINIATURIZED PAPER CHROMATOGRAPHY SYSTEMS FOR RADIOCHEMICAL PURITY DETERMINATION OF Tc-99m-SESTAMIBI. A.L. King, W.M. Oswald, and J.C. Hung. Nuclear Medicine, Department of Diagnostic Radiology, Mayo Clinic, Rochester, MN.

The recommended method for the determination of radiochemical purity (RCP) value of Tc-99m-sestamibi utilizes an aluminum oxide coated plastic thin-layer chromatography (TLC) plate with $\geq 95\%$ ethanol as the developing solvent. However, this TLC method is tedious and time-consuming (*i.e.*, 30-40 min). Two miniaturized paper chromatographic methods using ethyl acetate as the mobile phase have been proposed recently for testing the purity level of Tc-99m-sestamibi. The purpose of this study was to compare the standard TLC method with the two mini-paper chromatography methods: (1) Whatman 31ET paper (0.7x8 cm) with origin line and solvent front (S_f) marked at 1 cm and 7 cm from the bottom of the strip, respectively and (2) Whatman 3MM paper (0.5x7 cm) with origin and S_f at 1 cm and 5 cm above the bottom of the strip, respectively. Overall developing time and accuracy level in the critical range of RCP (*i.e.*, 88-92%) was evaluated. Due to the significant streaking problem associated with both paper chromatography methods, the cut lines for Whatman 31ET and 3MM were set at 1.5 cm and 2 cm from the bottom of the strip, respectively. The solvent developing time for the Whatman 31ET method (153.7 ± 6.6 sec, $n=10$) was faster than the Whatman 3MM method (209.8 ± 10.4 sec, $n=10$) by ~ 1 min. At the 92-93% RCP range as determined by the recommended TLC method, purity levels of Tc-99m-sestamibi measured by the Whatman 31ET and 3MM methods were $92.0 \pm 0.4\%$ and $91.9 \pm 0.5\%$, respectively ($n=5$). While the RCP value of Tc-99m-sestamibi samples was determined by the standard TLC method to be 86%, the Whatman 31ET method demonstrated a value of $88.3 \pm 0.7\%$ ($n=5$), whereas the Whatman 3MM method demonstrated $86.8 \pm 0.6\%$ ($n=5$). In conclusion, the results of our comparison study indicated that with the proper cut lines, both the Whatman 31ET and 3MM miniaturized paper chromatography methods with ethyl acetate as the developing solvent can measure RCP value of Tc-99m-sestamibi accurately and rapidly, although the Whatman 31ET method is slightly faster than Whatman 3MM method.

Posterboard No. 1603

VALUE OF POSTERIOR OBLIQUE VIEWS IN DETECTING CHEST WALL BREAST CANCEROUS LESIONS. S. Kothapalli, H.L. Pham, F. Mishkin. Division of Nuclear Medicine, Harbor- UCLA Medical Center, Torrance, CA.

Breast cancer (CA) is the second most common CA among women in the United States. With the introduction of scintimammography, characterization of breast lesion has been improved when combined with traditional imaging methods. Anterior and lateral images of the breast are routinely obtained in scintimammography. Preliminary studies suggest posterior oblique views may offer additional information that supplement the routine views by clarifying lesions in close proximity to the chest wall. Localization of the lesion is important for the diagnosis and treatment of breast CA.

Thirty women (age ranges 25-60 years) with abnormal mammograms were randomly selected for this study. Each patient was injected intravenously (IV) with 740 MBq of Tc-99m Sestamibi and imaged 5 minutes post IV in a prone position. Each 10 minute lateral view was followed by a 10 minute oblique view. The images were processed and displayed on hardcopy in two ways: one with oblique view and one without. All images were evaluated for focal increased uptake in the breast area by two Nuclear Medicine Physicians. Each physician scored the findings as either negative, equivocal or positive. The data was plotted using linear regression to determine the correlation coefficient r . The r values measured 0.7 for one observer, 0.6 for the other. These data show oblique views didn't add any more diagnostic information to the lateral views in patients suspected having breast CA. However, oblique views helped in one case showing a lesion that couldn't be seen on the lateral view. Unfortunately, this

didn't help the study because the pathological results are unknown. The physicians' preference as to which method to use will probably determine whether or not oblique views should be added.

Posterboard No. 1604

DETECTABILITY OF LESIONS WITH MASKING AND WITHOUT MASKING FOR DIAGNOSIS OF BREAST CANCER. V. Valdivia, H. L. Pham, F. Mishkin. Division of Nuclear Medicine, Harbor-UCLA Medical Center, Torrance, CA.

Breast carcinoma is the second most common cancer found in women today. Scintimammography provides a new way to aid in the detection of breast cancer. Uptake in organs near the chest wall, interfere with interpretation of the scintimammogram. Therefore, if masking is applied to eliminate any activity from surrounding organs, it may provide better detectability of small breast tumors. The purpose of this study was to determine whether or not masking provided more diagnostic information in patients with breast cancer.

Twenty three women with a suspicious mass, or a clinically palpable mass on physical examination, were injected intravenously with 740 MBq of Tc99m Sestamibi. Two 10 minute lateral views were acquired in the prone position, followed by a 10 minute anterior image. All pictures were displayed on a hard copy using a gray scale. The images were processed and displayed in two ways: one with masking high uptake organs and one without masking. Two radiology physicians blindly reviewed both sets of films separately, and scored the findings as either negative, equivocal, or positive. The readings were analyzed to determine the sensitivity and specificity, and plotted to determine the receiver operating characteristic curve. The results demonstrated that one reader is better with masking and the other reader was better without masking. In conclusion, in this small sample masking images does not appear to make any significant difference in the diagnostic utility of the scintimammogram. The physician's preference on which method to use will probably determine whether or not masking should be employed.

CONTINUING EDUCATION

Listed on the following pages is an overview of each SNM-TS course being offered at the SNM 44th Annual Meeting. Credit hours may change. Dates, times and rooms are subject to change. Please check the Program/Show Directory.

SATURDAY, MAY 31 AND SUNDAY, JUNE 1

ADVANCED CARDIAC LIFE SUPPORT PROVIDER INITIAL TRAINING (ACLS)

Time: 8:00 a.m.–3:45 p.m.
CME: 6.0

Room: 205
VOICE: 6.0

Advanced Cardiac Life Support Provider Initial Training (ACLS)
John Bovia, EMTP

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Demonstrate BCLS skills as they pertain to the complete management of an arrested patient.
2. Describe and demonstrate the adjuncts for providing an effective airway and adequate oxygenation in the cardiac arrest situation.
3. Recognize and specify appropriate pharmacologic and/or therapeutic modalities for the following ectopy of dysrhythmias: ventricular fibrillation; asystole; AV block—first degree, second degree (Mobitz I & II), third degree; electromechanical dissociation; bradycardia with hypotension; premature supraventricular complexes; and premature ventricular complexes.
4. Demonstrate the ability to recognize cardiac arrest and initiate treatment, including defibrillation and synchronized cardioversion.
5. Describe specific drug therapy, as appropriate, for the aforementioned dysrhythmias.
6. Identify the need for stabilization of the cardiac arrest patient at the scene and also during transplantation to a tertiary care facility.

Summary: This course is designed to provide an opportunity for nuclear medicine technologists to receive initial provider training and certification of advanced cardiac life support skills. Professional training will be provided by faculty members of Life Support Services, who provide training for Mayo Medical Center, University of Michigan and Northwest Anesthesia Seminars. To be eligible for this class, participants must have completed a basic life support training course within the last three years. The AHA Textbook of Advanced Cardiac Life Support along with course information will be mailed to all registrants. ACLS Provider certification cards will be provided to those who successfully complete the course.

Organizer: Nanci Burchell, CNMT

THE INTERNET FOR BEGINNERS

8:00 a.m.–3:45 p.m.
CME: 4.0

CPE:4.0

Room: Fiesta E
VOICE: 4.0

The History, Organization and Function of the Internet
Obtaining Access to the Internet
Internet Services
Medical Resources
Surfing the Net—Demonstrations with Audience Suggestions

Panel:

Jerry Glowniak, MD; Barbara Croft, PhD; Frances L. Neagley, CNMT

Educational Objectives: Upon the completion of this course, the attendee will:

1. Have knowledge of the origin and history of the Internet.
2. Understand how the Internet functions.
3. Understand how to access the Internet and search the World Wide Web.
4. Understand how to access medical resources on the Internet.

Summary: The Internet is a rapidly growing and changing entity that allows access to a wide range of information. Although the Internet has been around more than 25 years, it has only been within the last two to three years that access has become relatively inexpensive and widely available to the general public. This course will describe the basic organization of the Internet, define acronyms and processes used in working with the Net and demonstrate methods of logging on and searching for information.

Organizers/Moderators: Frances L. Neagley, CNMT; Barbara Y. Croft, PhD

SUNDAY, JUNE 1

QUALITY CONTROL (QC) OF SCINTILLATION DETECTORS ROAD SHOW

8:30 a.m.–noon
CME: 2.75

CPE: 2.75

Room: Fiesta D
VOICE: 2.5

What It Takes to Make a Count: The Basic Physics of Detection Using Sodium Iodide and Pulse Height Analysis

L. Stephen Graham, PhD, FACR

Converting CPM to DPM and All the Obstacles Between
Audrey Wegst, PhD

Quality Control of Nonimaging Sodium Iodide-Based Systems
Mary Ann Dell, MS

Equipment Demonstration

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Explain the proper use of single- and multi-well counters, collimated flat-field detector systems and beta counters.
2. Explain in detail the methods used to convert from counts per minute to units of radioactivity.
3. Discuss the instrument parameters to be tested in a QC program.
4. Set up an adequate QC program for the equipment noted in item one.
5. Interpret the results of the QC tests for each type of equipment.

Summary: Sodium iodide-based counting systems have long been used in the nuclear medicine community for gamma-emitting radioisotope measurement and identification in clinical applications. Collimated flat-field detectors are used for thyroid uptakes, bioassay and, more recently, perfusion studies. Shielded drilled well detectors provide excellent sensitivity for low activity measurements and are used for in vitro testing, RIA and wipe tests. In addition, most systems have a multi-channel analyzer for isotope identification. Newly developed thin-crystal detectors optimized for bremsstrahlung are now available for measurement of beta-emitting radiopharmaceuticals. Newer systems control calibration adjustments (voltage, gain, zero, detection limits, etc.) completely by software and include algorithms for most common calculations. Although these varied detectors provide a wide range of measurement capabilities, the approach to quality assurance for these systems is similar. Quality assurance tests should include count rate linearity, reproducibility, energy calibration, electronic noise compensation, efficiency determination drift, long-term stability, detector resolution and geometric variability. For systems designed for low-level counting, the minimal detectable activity (MCA) should also be established. Multi-well systems require detector variability and "cross talk" determination. All microprocessor controlled systems must include internal checks of data, memory, storage and retrieval functions, and communication, as well as provide software verification to the user. In addition, biomedical departments should perform preventive maintenance checks on electrical and mechanical components. The basic physics of sodium iodide detectors, principles of operation and specific quality assurance procedures for the above-referenced tests will be provided. Common user errors will be discussed. Acceptable result ranges and frequency of QC tests will be recommended. In addition, appropriate quality assurance documentation will be suggested to satisfy various regulatory agencies.

Organizer: Audrey V. Wegst, PhD

SKILLS FOR THE NUCLEAR CARDIOLOGY TECHNOLOGIST

8:00 a.m.–5:00 p.m.
CPE: 6.5

Room: Fiesta B, C
VOICE: 4.5

Indications for Stress Testing
Yasmin Allidina, CNMT

Modes of Stress Testing
Brenda McSherry, CNMT

Patient Interview
Julio Rodriguez, CNMT

Patient Preparation/Imaging Guidelines
Wendy Bruni, CNMT

Patient Monitoring/Basic ECG Interpretation
Janice Preslar, CNMT

Hands-On Demonstration
Interactive Response Session

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. List several indications for a perfusion stress test.
2. Explain all currently available modes of stress testing, including exercise and pharmacologic, and recognize the clinical utility of each.
3. Accurately obtain a cardiac patient history, adequately explain the stress test, obtain informed consent and answer patient questions.
4. Have a basic understanding of cardiac medications and any effect they may have on the test.
5. Know how to prepare the patient for the stress test: i.v. insertion, obtaining baseline blood pressure, heart rate and ECG recordings. Apply different imaging techniques to obtain high-quality images.

6. Know how to properly monitor the patient during the stress test and understand the technologist's role during an emergency.
7. Recognize normal and abnormal ECG patterns.

Summary: This session is designed to provide a practical approach to stress testing for nuclear medicine technologists who are working in an era of multiskilling. The course will begin with a series of classroom lectures that will provide basic information on coronary artery disease and will focus on skills that are necessary for a technologist to adequately and safely prepare, instruct and monitor patients during a stress test. Information on basic ECG interpretation, handling emergency situations and suggested imaging guidelines will be provided. The second half of the session will provide hands-on demonstrations of the above. The course will end with an interactive session that will provide technologists with an opportunity to assess their skills.

Organizer/Co-moderator: Brenda McSherry, CNMT

Moderator: Yasmin Allidina, CNMT

MONDAY, JUNE 2

JRC WORKSHOP

11:00 a.m.–4:00 p.m.

Marriott Rivercenter Hotel

JRC Workshop

Elaine J. Cuklanz, CNMT

Educational Objectives: Upon completion of this course, the attendee will:

1. Review the proposed revision of the *Essentials and Guidelines of Accredited Educational Programs for the Nuclear Medicine Technologist*.
2. Submit recommendations for changes in the Self Study Application.
3. Discuss the costs associated with the accreditation process.

Summary: Attendees in the workshop will review changes in the *Essentials* resulting from comments received during the 1995 workshop and questionnaires provided to the community of interest. Using this revision, the attendees will submit recommendations for revision of the Self Study Application. The group will then consider the costs associated with the accreditation process and operation of nuclear medicine technology programs.

Organizer: Susan Laffin, CNMT

BEEN THERE, DONE THAT—MARKETING PROJECTS THAT WORKED

12:00 p.m.–2:00 p.m.

Room: 101 A, B
VOICE: 1.5

Panel:

Mary Jo Struttman, CNMT; Karen Pomnean, CNMT; Nanci Burchell, CNMT; PR Star Winners

Educational Objectives: Upon completion of this presentation, the attendee should be able to:

1. Identify specific target markets that have benefited from a marketing project.
2. Estimate projected budget dollars needed for marketing projects.
3. Understand how to organize a team to complete objectives.
4. List resources available from vendors and others to support project.
5. Develop methods to measure success of project.

Summary: This interactive forum will allow the attendee to learn from other technologists how they developed and implemented a target marketing project for their department. Some will share positive results of promoting Nuclear Medicine Week or their results of a specific marketing project. An opportunity for questions and answers about

budgets, what changes they would make and most importantly how the project affected their business. Materials available for educational use will also be discussed.

Organizer: Joni L. Herbst, CNMT

CLINICAL RESEARCH IN NUCLEAR MEDICINE

12:30 p.m.–3:45 p.m.

CME 3.0

CPE: 3.0

Room: Fiesta B, C

VOICE: 3.0

Introduction to Clinical Research: Concepts and Definitions

Eileen O. Smith, MBA, CNMT

Development of a Radiopharmaceutical

Joseph Glajch, PhD

Equipment Software Testing in Hospitals and Clinics

Richard Nuccio, MBA, CNMT

How to Write a Scientific Abstract

Monica Geyer, CNMT

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Identify four specific areas where nuclear medicine technologists participate in clinical research.
2. Define common terminology and acronyms used in clinical research, such as NDA, IND, FDA, Form 1572, sponsor, consent form and principal investigator.
3. Describe the process whereby an investigational compound becomes an FDA-approved radiopharmaceutical.
4. Discuss hospital and clinic-based beta site testing of new cameras and software and how nuclear medicine technologists are involved in the process.
5. Describe how to write and present a scientific abstract.

Summary: This course is intended for nuclear medicine technologists who are curious about how clinical research is done in the hospital and clinic setting. Speakers will focus on specific examples of nuclear medicine research and development and how technologists can be a critical part of the process. Specific areas to be covered include a review of basic research terms and acronyms, new radiopharmaceutical development and beta site testing of cameras and software. In the final session, attendees will learn how to set up an experiment to answer a clinical problem, write and submit an abstract, and give a scientific presentation.

Organizer/Moderator: LisaAnn Trembath, CNMT

CHANGING THE WORKPLACE CULTURE TO A HEALTHY ENVIRONMENT FOR YOUR EMPLOYEES

2:15 p.m.–3:45 p.m.

Room: 101 A, B

VOICE: 1.5

Changing the Workplace Culture to a Healthy Environment for Your Employees

Nancy Neuchterlein, MFCC

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Discuss the stress-related situations found in the American workplace and how changes in health care have affected their environment.
2. Define types of healthy workplace environments and steps to creating one in their institution.
3. Understand how work teams operate to become effective.
4. Identify the basic needs of the "valuable" employee.

5. Understand new concepts in workplace culture and how to organize teams to approach and complete their work in different ways.

Summary: Reorganization, downsizing, rightsizing, mergers, acquisitions and a complete change in how health care is delivered has caused many stressful times for the nuclear medicine manager and their employees. This 90-minute session will address the changes occurring in many management circles today. Special attention will be given to how health care organizations specifically need to create a healthy work environment for their employees. Discussion will include how managers can organize their work teams to become more productive and effective during times of staff reductions and budget constraints. An interactive session will include case studies of how managers were able to effect change in their work culture and an opportunity for attendees to share their specific problems will be provided.

Organizer/Moderator: Joni L. Herbst, CNMT

TUESDAY, JUNE 3

EDUCATOR'S FORUM: NMTCB

8:00 a.m.–9:30 a.m.

Room: 206

NMTCB Computer Adaptive Testing: A One-Year Update

Patricia C. Wells, CNMT

Educational Objectives:

1. Discuss the methods used to keep the NMTCB exam current as clinical practice changes.
2. Use the NMTCB Components of Preparedness Statements to help students review and prepare for the NMTCB exam.

Summary: This session is intended to discuss the first-year experience with the CAT format. Educators and others interested in this method of computerized testing will find this session informative.

Organizer: Susan Laffin, CNMT

NUCLEAR CARDIOLOGY I: INTRODUCTION

8:00 a.m.–9:30 a.m.

CME: 1.5

CPE: 1.5

Room: Fiesta B, C

VOICE: 1.5

The Importance of Quality—Technologist's Role

Donna Natale, CNMT

Choosing a Radiopharmaceutical

Frans J. Th. Wackers, MD, PhD

Pharmacologic Stress Techniques

Brenda McSherry, CNMT

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Discuss the importance of the technologist's role in producing high-quality imaging studies.
2. Compare several different myocardial perfusion imaging agents and explain the differences, advantages and disadvantages of each.
3. Explain protocols for vasodilator and catecholamine pharmacologic stress studies and understand indications, possible side effects and safety of each.

Summary: To develop a complete understanding of the importance of obtaining high-quality studies, the session begins with a discussion that reinforces the crucial role played by the technologist. The session continues with an evaluation of the vast selection of myocardial perfusion imaging agents available, including the efficacy and value of each. Lastly, an overview of available pharmacologic stress agents will be presented including indications, protocols and side-effect profiles.

Organizer/Moderator: Donna Natale, CNMT

Co-Moderator: Lynn Sillman, CNMT

GASTROINTESTINAL

8:00 a.m.–11:15 a.m.

CME: 1.5

CPE: 1.5

Room: Fiesta E

VOICE: 1.5

A Community Hospital's Perspective on WBC Imaging

Kathleen M. Krisak, CNMT

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Discuss the value of WBC imaging using HMPAO in the evaluation of patients with suspected appendicitis.
2. Describe the labeling procedure and how safe and simple it is to label WBCs in house.
3. Describe indications for using WBC imaging in osteomyelitis patients.

Summary: This course is designed for technologists and physicians in the diagnostic evaluation of patients using labeled WBC imaging. Topics covered will include appendicitis and osteomyelitis. Also, review the WBC labeling procedure and show how safe, simple and cost effective it can be for a community hospital to label in house.

Organizer: Kathleen M. Krisak, CNMT

Moderators: William Wood, CNMT; Jerry Dowd, CNMT

ONCOLOGY: NUCLEAR MEDICINE'S ROLE IN DETECTION, TREATMENT AND PAIN MANAGEMENT

8:00 a.m.–11:15 a.m.

CME: 3.0

CPE: 3.0

Room: 101 A, B

VOICE: 3.0

Ebrahim S. Delpassend, MD

Donald A. Podoloff, MD

Mammoscintigraphy

Javier Villanueva-Meyer, MD

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Understand the different isotopes available for imaging, treatment and pain management.
2. Be able to discuss the differing roles of gallium, thallium, receptor imaging agents and monoclonal antibodies for cancer detection.
3. Be able to discuss the current utilization of ^{99m}Tc -sestamibi as an indicator of malignant breast tumors to include clinical indications and how to set up the procedure.
4. Understand the therapeutic applications of the available radiopharmaceuticals: such as ^{131}I , ^{89}Sr , ^{153}Sm and ^{166}Ho .

Summary: This session will include the use of gallium, thallium and various new agents available that include receptor imaging agents in addition to newly-approved monoclonal antibodies. The technologist will understand the different roles of the various radiopharmaceuticals available for cancer detection. A discussion of nuclear medicine mammoscintigraphy will be included. At the conclusion of the lecture, the technologist should be able to understand the clinical indications and have a general understanding of how to set up planar imaging for this procedure. The therapeutic use of radioisotopes in pain management, ^{89}Sr , ^{153}Sm and ^{166}Ho will be discussed. The participant will understand the important role of nuclear medicine in relieving pain in a particular cancer patient population. The therapeutic use of ^{131}I in the treatment of thyroid carcinoma also will be discussed.

Organizer/Moderator: Janet Champagne, CNMT

Co-Moderator: Julie Blust, CNMT

EDUCATOR'S FORUM: TESTING PSYCHOMETRICS

9:45 a.m.–11:15 a.m.

Room: 206

VOICE: 1.5

Educator's Forum: Testing Psychometrics

Nancy Sawyer, CNMT

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Understand test psychometrics used to evaluate criterion referenced testing.
2. Discuss the statistics that comprise psychometric standards for criterion referenced testing.

Summary: Psychometric standards are used to measure the performance of a criterion referenced examination. This presentation will provide an overview of the NMTCB exam, as well as psychometric standards used to confirm that the exam is testing the knowledge necessary for the entry-level technologists.

Organizer: Susan Laffin, CNMT

NUCLEAR CARDIOLOGY II: CHEST PAIN IMAGING

9:45 a.m.–11:15 a.m.

CME: 1.5

Room: Fiesta B, C

VOICE: 1.5

Evaluation of Chest Pain—Indications for Testing

James Udelson, MD

Acute Chest Pain Imaging

Michael White, CNMT

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Describe different types of chest pain (i.e., typical vs. atypical) and appropriate indications for testing.
2. Discuss the importance of acute chest pain imaging in relation to health care reform.
3. Discuss logistics and potential problems associated with acute imaging.

Summary: The session will begin with a discussion of the interpretation of patient chest pain syndromes and appropriate testing. The role of acute chest pain imaging in relation to decreasing inpatient length of stay, unnecessary inpatient admitting and overall savings for the patient, hospital and insurance carrier will be discussed. The logistics of acute imaging, including isotope availability and necessary staffing, will be discussed. Finally, imaging protocols and case studies will be presented.

Organizer: Donna Natale, CNMT

Moderators: Brenda McSherry, CNMT; Lyn Melberg, CNMT

BLOOD CONTAMINATION IN THE NUCLEAR MEDICINE LABORATORY

9:45 a.m.–11:15 a.m.

CME: 1.5

CPE: 1.5

Room: 207

VOICE: 1.5

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Understand the risks associated with blood contamination in a nuclear medicine laboratory.
2. List potential sites for blood contamination in the laboratory area.

3. Describe methods for successful decontamination of identified sites.

Organizer/Speaker: Kristen Waterstram-Rich, CNMT

CENT\$ AND SENSIBILITY: HOW TO SURVIVE AND THRIVE IN A CHANGING PAYER ENVIRONMENT

12:30 p.m.–3:45 p.m.

CME: 3.0

CPE: 3.0

Room: 207

VOICE: 3.0

How to Survive and Thrive in a Changing Payer Environment

Mary Jo Struttman, CNMT; Gail M. Rodriguez, MA

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Understand Medicare reimbursement policies for radiopharmaceuticals and nuclear medicine procedures.
2. Assist their institutions in coding correctly and, thereby, ensure appropriate levels of reimbursement.
3. Understand the trend toward managed care in both public and private payers, and its implications for nuclear medicine.
4. Discuss the outcomes of research and basic marketing principles and the roles they will play under the constraints of managed care.
5. Assess their departments' services, strengths and value as well as their weaknesses and needs.
6. Create strategies and tactics that will successfully promote nuclear medicine.

Summary: This program is designed to provide information on how radiopharmaceuticals and nuclear medicine procedures are reimbursed. Participants will receive specific training on correct coding for Medicare claims, with an emphasis on how to use this knowledge to obtain appropriate reimbursement. This information will be discussed within the context of the changing managed care environment. As managed care and capitated payment arrangements evolve, it is critical that nuclear medicine professionals understand the systemic constraints of these changes and be able to thrive under them. This program will demonstrate that, to achieve success, both clinical and economic efficacy must be proved through the generation of solid outcomes data. The generation of a marketing strategy and supporting tactics for disseminating these data will comprise the second portion of this program.

Organizer: Gail M. Rodriguez, MA

Moderator: Mary Jo Struttman, CNMT

NUCLEAR CARDIOLOGY III: SPECT IMAGING AND PROCESSING GUIDELINES

12:30 p.m.–2:00 p.m.

CME: 1.5

Room: Fiesta B, C

VOICE: 1.5

Imaging Protocols

Andre Gagnon, CNMT

SPECT—Reconstruction/Filtering

Paul DeMan, CNMT

Quantitative Programs/Interpretation

Russell Folks, CNMT

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Understand various imaging protocols allowing them to design protocols specific to the needs of their laboratory.
2. Select proper reconstruction and filtering parameters for a variety of SPECT studies.

3. Evaluate several quantitative programs and understand how they affect image interpretation.

Summary: All aspects of cardiac imaging, from acquisition to processing, will be included in this three-part session. First, imaging protocols will be reviewed with emphasis placed on the ability to individualize, based on specific laboratory needs. Issues relating to patient throughput and efficient utilization of equipment and technologist time will be addressed. Next, a review of the principles of SPECT processing will be discussed including filtered backprojection, iterative reconstruction and filter selection. The session will end with a review of some quantitative programs, including Cequal and Circumferential profiles, and the impact they have on image interpretation.

Organizer: Donna Natale, CNMT

Moderator: Andre Gagnon, CNMT; Michael White, CNMT

RADIATION SAFETY

12:30 p.m.–3:45 p.m.

CME: 3.0

CPE: 3.0

Room: 101 A, B

VOICE: 3.0

Hot Topics From the NRC

JCAHO Survey

Susan McLaughlin

Special Considerations When Handling 511-keV Tracers

Valerie R. Cronin, CNMT

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Explain the radiation safety regulations relevant to nuclear medicine as set forth by the NRC.
2. Describe procedures to prepare for a JCAHO, NRC or state inspection and the penalties for noncompliance.
3. Review the current radiation safety protection issues in nuclear medicine.
4. Know the common areas of noncompliance in nuclear medicine departments with respect to NRC and JCAHO inspections.
5. Understand the unique radiation safety aspects of working with and administering 511-keV radiopharmaceuticals.

Summary: This course will be a review and update of guidelines and regulations pertinent to radiation safety issues. It will review regulations and recommendations, regulatory inspection procedures, quality management program requirements, current radiation safety issues, interesting sources of radiation exposure and generation and the safe handling of 511-keV radiopharmaceuticals. The purpose of this session is to provide the participant with current information on the radiation safety issues most relevant in today's nuclear medicine environment.

Organizer: Kristen M. Waterstram-Rich, CNMT

Moderator: Mary Dalipaj

NUCLEAR CARDIOLOGY IV: UPDATE ON NEW IMAGING

2:15 p.m.–3:45 p.m.

CME: 1.5

CPE: 1.5

Room: Fiesta B, C

VOICE: 1.5

Gated SPECT

E. Lindsey Tauxe, CNMT

Dual Isotope Imaging

Monica Geyer, CNMT

Attenuation/Scatter Correction

Paul Christian, CNMT

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Discuss appropriate acquisition and processing techniques for obtaining high-quality gated SPECT studies.
2. Explain dual-isotope imaging protocols and discuss the impact on overall clinical operations.
3. Discuss principles and acquisition and processing techniques for attenuation and scatter correction.

Summary: The session will begin with a review of acquisition and processing protocols, along with case presentations of gated SPECT studies. Next, the clinical utility of dual-isotope myocardial perfusion imaging will be discussed, including its impact on efficiency, patient throughput and image quality. Imaging protocols and case studies will be presented. The last topic will focus on current methods being employed for attenuation and scatter correction. Acquisition and processing techniques, along with case studies, will be compared to conventional imaging studies.

Organizer: Donna Natale, CNMT

Moderators: Patti Corrigan, CNMT; Vicki Sharp, RTN

WEDNESDAY, JUNE 4

OPTIMIZING THE ART OF CLINICAL NEUROPECT TECHNOLOGY

8:00 a.m.–11:15 a.m. Room: **Fiesta B, C**
CME: 3.0 CPE: **3.0** **VOICE: 3.0**

Neuroanatomy for Brain SPECT
Leighton P. Mark, MD

Capturing the Moment: Reasons to Know What's Happening at the Time of Injection and Scan
David H. Lewis, MD

Fourier Space and Apodization Makes Reconstruction Theory Easy
I. George Zubal, PhD

Current Clinical Practice of rCBF in SPECT
Tom C. Hill, MD

Educational Objectives: Upon completion of the course, the attendee should be able to:

1. Accurately locate the major areas of the cerebral cortex and sub-cortex using brain SPECT images.
2. Describe the major functions associated with different areas of the human brain.
3. Review the specialized technical aspects of pharmaceutical preparation and injection and of SPECT quality imaging and image processing.
4. Discuss indications for performing regional cerebral blood flow SPECT.

Summary: This course is intended for technologists who are interested in improving their neuroSPECT imaging skills and knowledge. It will focus on the elements of neuroanatomy and the resultant neurophysiology, which will provide a greater level of understanding of the regional cerebral blood flow (rCBF) scan. The attendees will learn the specialized conditions associated with rCBF scans (radiopharmaceuticals, influences of the immediate environment on the patient at the time of injection and scan and the specifics of the differing reconstruction algorithms/filters for clinical interpretations). They will also recognize the variety of applications of rCBF in current clinical practice.

Organizers/Moderators: Eileen O. Smith, CNMT; LisaAnn Trembath, CNMT

Co-Moderators: Michele Early, CNMT; Barbara Rossi, CNMT

ITEM WRITER'S WORKSHOP

8:00 a.m.–3:45 p.m.

Room: 205
VOICE: 1.0

Item Writer's Workshop
Daniel Leahey, MA, CNMT

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Develop multiple-choice questions following the principles and conventions of multiple-choice item writing.
2. Recognize common problems associated with multiple-choice questions.
3. Apply these principles to the classroom exams and/or NMTCB item writing.

Summary: This presentation is made by the NMTCB to provide guidance for writing and preparing examination items. The emphasis will be on writing items for computer adaptive testing on the content of the NMTCB exam. This workshop is useful for the classroom instructor, new NMTCB item writers and anyone else who is charged with writing test questions; such as, for in-service presentations, JCAHO competency validation, continuing education lectures, etc. Handouts and workshop activities will include examples of well written and poorly written questions, how to critique items and how to write questions for computer exams.

Organizer: Susan M. Laffin, CNMT

NON-NUCLEAR SKILLS AND COMPETENCY

8:00 a.m.–11:15 a.m.
CME: 3.0

Room: 101 A, B
VOICE: 3.0

Altered Biodistribution Patterns of Radiopharmaceuticals: Causes and Answers
Jay Spicer, MS

How to Catheterize a Patient
Kim Maas, CNMT

How to Handle Pediatric Patients in an Adult Environment

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Define what altered biodistribution is, what causes it and to classify altered biodistribution of radiopharmaceuticals into separate categories.
2. Know the physiological makeup of the urinary system. How to approach the male versus female patient for catheterization and pitfalls that may arise.
3. What makes the pediatric patient different from the adult patient. Why a little preparation and understanding can save a lot of time.

Summary: This course was designed for technologists and physicians involved in clinical settings that include adults as well as pediatric patients. Topics covered will include pharmaceuticals that alter distribution of radiopharmaceuticals in patients, how to catheterize a patient and handling pediatric patients in an adult environment.

Organizer: Patti Corrigan, CNMT

Moderators: Russell Folks, CNMT; Dan Basso, CNMT

HEALTH CARE POLICY: HOW IT AFFECTS NUCLEAR MEDICINE AND WHAT WE CAN DO ABOUT IT

2:15 p.m.–3:45 p.m.
CME: 1.5

Room: Fiesta B, C
VOICE: 1.5

The Legislative Process
David Nichols

Current Political Issues Facing Nuclear Medicine
Joe Gagen

Educational Objectives: Upon completion of this session, the attendee should be able to:

1. Describe the legislative process used to pass a bill into law.
2. Discuss the current political agenda as it relates to health care, particularly nuclear medicine.
3. Review what nuclear medicine technologists can do to make a difference in charting the course that our profession will take.

Summary: During the last few years, health care has undergone dramatic changes. This course is designed to enhance participants' knowledge of the important role the federal government plays in nuclear medicine through influencing the design and credentialing of allied health programs, approval of funding, and the issuing and enforcing of regulations. Current issues in Congress will be discussed. The process by which a bill becomes law will also be reviewed so that a better understanding of how we make a difference can be emphasized.

Organizer/Moderator: Lynne T. Roy, CNMT

Co-Moderator: LisaAnn Trembath, CNMT

HISTORICAL PERSPECTIVE OF 511-keV PHOTON IMAGING

2:15 p.m.–3:45 p.m.
CME: 1.5

Room: 207
VOICE: 1.5

Educational Objectives: Upon completion of this course, the attendee should be able to:

1. Describe the production of 511-keV photons by positron-emitting radionuclides.
2. Describe the evolution of coincidence detection imagers.
3. Understand the current status and future prospect for 511-keV photon imaging.

Organizer/Speaker: Dayton Rich, CNMT

THURSDAY, JUNE 5

SPECIAL INTEREST FOCUS/GROUP MEETING

8:00 a.m.–11:15 a.m.

These are non-credit meetings designed to provide a forum to interact and discuss topics of mutual interest with your peers. The subjects of interest are: cardiology, neurology, pediatrics, oncology and educators.

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