Abstracts for the Technologist Section Scientific Papers:
SNM 27th Annual Meeting Program—Detroit, Michigan, 1980

A Note from the Scientific Program Chairman

The Scientific Program Committee of the Technologist Section of the Society of Nuclear Medicine is pleased to present the abstracts of the scientific papers that will be given during the 27th Annual SNM Meeting. To allow for maximum attendance, the scientific papers are scheduled to be presented during two consecutive days (in the same room on both days); Tuesday, June 24 beginning at 11:00 a.m. and Wednesday, June 25 beginning at 9:30 a.m. Fifteen minutes are allotted for each paper to be presented and the papers will follow in the order in which they are listed below.

Although I urge meeting-goers to attend all these sessions in support of your fellow technologists, please note that the Scientific Program Committee has grouped papers together by topics—to enable you to preschedule your time according to your area of interest. The titles and authors of the Section's scientific exhibits are also to be found in this section of the *Journal* and they too should interest all attendees.

—Elizabeth A. Joyce

Tuesday, June 24 — Room 3123
Cobo Hall — 11:00 a.m.-4:45 p.m.

Submitted Papers

Moderator: Janice O. Brewster

CARDIOVASCULAR NUCLEAR MEDICINE IN THE CCU. R. Bontemps, R. Steingart, T. Yipintsoi, J. Wexler, and L.M. Freeman. Albert Einstein College of Medicine and Montefiore Hospital and Medical Center, Bronx, NY.

The increased use of mobile scintillation cameras and their application to cardiovascular nuclear medicine has placed the nuclear medicine technologist in a new clinical environment and a thorough understanding of the medical situations that the technologist will encounter is now necessary. Since the camera can go to the patient, patients who cannot be moved can now be imaged. The patient-technologist interaction now occurs with critically ill patients rather than in the more controlled environment of the nuclear medicine lab, and the technologist must sense that his role has changed. He is now much more critically involved with immediate and possibly life-sustaining measures which arise in caring for the critically ill. The technologist must learn to function, relate and work directly with not only physicians but with a nursing staff which has had little or no exposure to nuclear medicine. These procedures are now used both for diagnosis and in monitoring response to varying therapies or interventions, and the results from these procedures, available almost immediately, can greatly influence patient care. Additionally, since these patients may have life-support systems in place, knowledge of these systems is necessary. Presentation of some of the situations which may arise will be made. These will include respirators, Swan-Ganz catheters and intra-aortic balloon pumps (IABP). As well, examples of some of the types of clinical cases to expect will be viewed as static images and on videotape. Typical cases, such as acute and subclinical ventricular infarcts and responses to IABP will be shown.

CARDIAC TOMOGRAPHY TECHNIQUE USING A ROTATING SLANT HOLE COLLIMATOR AND A PORTABLE CAMERA. R. Balon, K. Markwell, E. Byrom, D. Pavel. University of Illinois Medical Center, Chicago, IL.

The collimator fits a portable camera head, has parallel holes of 3 cm length, slanted by 25°, and rotates in 6 positions, for 6 views 60° apart. The reconstruction is based on a least squares iterative algorithm. Positioning: 40 LAO is used with the collimator touching the chest wall. The ventricle is positioned towards the center left of the field. Using the persistence scope the exact location can be checked in all 6 positions by using the rotating capability of the collimator without moving the camera head. An optimization of the acquisition and processing for Tl-201 was attempted based on phantom studies and on 21 clinical studies. Acquisition: for a usual dose, 3 to 5 min/view were adequate, yielding 90,000 → 325,000 cts/view. Processing: a standard processing of 12 planes, of 1.3 cm thickness, starting at 1 cm from the collimator surface was used in all cases. Varying the number of planes from 12 to 8 does not change the quality of the image. With 6 planes the resolution was slightly degraded. Varying the slice thickness to 1 cm decreased the sharpness of the reconstruction slightly. No false (+) or false (-) results were obtained as compared to the routine views and to the clinical and laboratory data. Phantoms: the small and large lesion in the Tl-201 phantom were clearly defined and their depth precisely estimated. Advantages of the rotating slant hole collimator: easy and rapid positioning; marked enlarged LV can be imaged; 3 of the 6 acquired images closely resemble the standard analog views and can be used as such; reconstruction starts at face of collimator; very good resolution; enables tomography at bed side.

DETERMINATION OF LEFT VENTRICULAR EJECTION FRACTION EMPLOYING A NON-COMPUTERIZED CARDIAC MODULE. K. Wilkins, L. Reese, F.S. Prato, St. Joseph's Hospital and University of Western Ontario, London, Ontario, Canada.

The cardiac module (CM), an inexpensive non-computerized Anger camera accessory, was evaluated for its determination of left ventricular ejection fraction (LVEF) and left ventricular wall motion (WM). Twenty-nine subjects were compared to established first pass (FP) and gated blood pool techniques (GSA).

For assessment of wall motion, gated images of the heart in both the left and right anterior oblique projections were produced by the CM. These were found not to be useful.

Two gated modes of operation of the CM were used in the determination of LVEF. In the automatic mode (CMA), left

ventricular background is automatically sampled within an anulus around the left ventricle. In the manual mode (CMM), background is separately sampled. Each determination took about 5 minutes. Intratechnologist reproducibility was superior for the CMM (r = 0.92) as compared to the CMA (r = 0.85). The CMM also compared better to GSA (r = 0.85), but there was no significant difference in comparison to FP. The LVEF values determined by the CM were considerably lower than those obtained by FP or GSA. It was found that these values could be increased by changing the technique of determining background. For this reason it is imperative that at each installation left ventricular ejection fraction results obtained with the cardiac module be calibrated against established techniques.

INTEROBSERVER VARIABILITY IN LEFT VENTRICULAR EJECTION FRACTION CALCULATION FROM EQUILIBRIUM GATED BLOOD POOL STUDIES. K. Zimmer, D. Gillmeister, M. Bialek, T. Buckrucker, J. Cuevas, and S.M. Spies. Northwestern Memorial Hospital, Chicago IL.

The purpose of this investigation was to determine the effect of experience and training on the accuracy of left ventricular ejection fraction (LVEF) calculation from equilibrium gated blood pool studies (GBP). Four groups of observers were defined as follows: Group I consisted of a nuclear medicine technologist with two years of experience in nuclear cardiology procedures; Group II consisted of a nuclear medicine technologist with one year of experience doing LVEF calculations; Group III consisted of a technologist who performed LVEF calculations on an occasional basis; Group IV consisted of a nuclear medicine technology student with basic instruction on the LVEF calculation procedure but with no practical experience. GBP studies were performed using a standard field of view or portable gamma camera interfaced to a dedicated digital computer system. Each study consisted of an RAO and LAO view, and each view divided the cardiac cycle into thirteen equal intervals. The individual LVEF determinations in each group (II-IV) were compared with the Group I results as a standard. The results showed little difference in accuracy between Group I and Group II. There was a slight decrease in accuracy when Group III was compared with Group I, and a highly significant difference between Groups I and IV. Experience is a fundamental requirement for individuals performing LVEF calculations from GBP data if accurate results are to be obtained.

POSITIONING CRITERIA FOR 7 PINHOLE CARDIAC TOMOGRAPHY. J.M. Clare, J.H. Thrall, T.J. Brady, W.L. Rogers, B. Pitt, University of Michigan Medical Center, Ann Arbor, MI.

In 7 pinhole tomography, the need to simultaneously position the heart in 7 images makes a positioning protocol essential. Based on theoretical considerations and practical experience in 300 stress Thallium-201 scans the following criteria have been developed for optimum collimator positioning. The heart should 1) be centered with respect to the central pinhole image, 2) occupy approximately 3/4 of the central field of view (FOV), 3) not be clipped in any of the peripheral views, 4) have its most circular appearance in the central view and, 5) be repositioned identically for the delayed images.

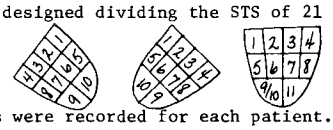
If the collimator is too close (heart >> 3/4 FOV) the images in the peripheral views are often clipped resulting in reconstruction artifacts. If the collimator is too far away (heart << 3/4 FOV) the sampling angle is reduced thereby diminishing the tomographic effect. The count rate sensitivity is also diminished. Centering the heart reduces the probability of peripheral clipping artifacts and is necessary to balance the count contributions from the peripheral views. Adjusting the degree of LAO and cephalad angulation so that the central pinhole image is the most circular increases the number of acceptable reconstruction slices (Nominal starting angles are 40° LAO, 10° cephalad with adjustments for individual patients). Noting the degree of angulation, the height of the collimator and its distance from the patient aids in repositioning for the delayed studies. Positioning must be identical for valid comparisons to be made between immediate post stress and delayed images.

Following these criteria aids heart positioning and improves the quality of 7 pinhole tomograms.

PREDICTION OF ANATOMIC LOCATION OF CORONARY ARTERY OBSTRUCTION BY QUANTITATIVE STRESS THALLIUM SCINTIGRAPHY. Wheeler, Goodenday, Leighton, Fraker, Nelson, Andrews, Holtgrieve. Medical College Ohio, Toledo, OH.

Qualitative methods of analyzing stress thallium scintigraphy (STS), have been unsuccessful in relating perfusion defects to location of coronary artery obstruction. We used a previously validated quantitative technique which defines perfusion defects based on anatomic location.

A transparent overlay was designed dividing the STS of 21 patients into ten segments.



The under perfused segments were recorded for each patient. Three cardiologists graded the coronary angiograms of these patients using the American Heart Association method.

The relationship between single vessel obstruction and STS defect area was examined. A predictive pattern was constructed from these data, and tested on patients with multiple vessel obstruction. Segments 7&9 which were under perfused in all patients with single vessel right coronary artery (RCA) obstruction were under perfused in 3 of 4 patients with combined left anterior descending (LAD) and (RCA) obstruction. Segments 9&10 were under perfused in 3 of 4 patients with single LAD obstruction. Segment 9 was under perfused in 13 of 15 patients with LAD disease regardless of RCA or circumflex obstruction. It appears there is overlap in patients with multiple vessel disease.

Finally, trends in patterns of perfusion defects signify specific combinations of obstructed coronaries. Poor predictive accuracy may be due to perfusion distribution in planar views. This problem may be solved by similar analysis of tomographic images.

A METHOD FOR OBTAINING REPRODUCEABLE THALLIUM MYOCARDIAL TOMOGRAMS. M. E. Powell, Medical College of Ohio, Toledo, Ohio.

Tomographic scintigraphy, using multiple pinhole apertures, is sensitive to camera position for several reasons. The projected image size is directly proportional to the distance of the object from the aperture and the reconstructed tomographic slice is perpendicular to the viewing axis. Since thallium myocardial scintigraphy often involves comparison of exercise and resting scans, it is important to obtain similar images.

The quality of tomographic images is dependent on insuring that the heart is centered on the viewing axis. This procedure is both time consuming and difficult. In order to alleviate this problem, a computer method to position the camera has been developed. The count totals of the images projected by three pinholes which are equal distance from the central axis are compared. Due to the inverse square law the total counts in each region of interest will relate directly to the distance of the heart from each pinhole. The camera is positioned by visual techniques in a 45° LAO position with a 25° cephalad tilt allowing the aperture to view directly along the major axis of the left ventricle. Once this has been accomplished a two minute preliminary scan is taken to evaluate the camera position. If the count totals in each region are equal the heart will be centered. Approximately 300,000 counts are accumulated once the camera is positioned. Three collimated light sources, mounted on the camera head, are used to mark the patient for subsequent positioning. This method reduces subjectivity and increases reproducibility of serial procedures.

A REPRODUCIBLE NEW METHOD FOR RADIONUCLIDE ASSESSMENT OF RIGHT VENTRICULAR EJECTION FRACTION USING PRE-PROCESSED MULTIPLE GATED EQUILIBRIUM SCINTIGRAPHIC IMAGES. K. Van

Train, D. Matsuoka, M. Freeman, J. Maddahi, D. Berman, A. Waxman, and E. Garcia. Cedars-Sinai Med. Ctr., L.A., CA

Previous methods for right ventricular (RV) ejection fraction (EF) calculations have been limited by subjective interpretation of RV borders from radionuclide images. Previously we validated* a non-automatic method of obtaining RVEFs using manually assigned end-diastolic and end-systolic regions of interest from unprocessed multiple gated equilibrium scintigrams (MGES) obtained in the 45° LAO view. The present study describes and validates a new approach to objective assessment of RVEF. In 20 patients RVEF calculated from pre-processed MGES was compared to RVEF obtained by our previously established method. Each study was evaluated independently by an expert and a non-expert investigator for evaluation of inter-observer agreement. Image processing consisted of weighted space-time smoothing, interpolative background subtraction(IBS) isolating the right ventricle, and automatic edge detection of the borders of the isolated right ventricle. IBS resulted in improved delineation of the pulmonic valve plane and improved separation of right atrial and RV chambers. RVEF obtained from pre-processed MGES and unprocessed MGES correlated well (r=.91, SEE=0.31). Interobserver agreement between expert and non-expert operators was better for the pre-processed MGES (r=.92, SEE=0.031) than for the unprocessed MGES (r=.82, SEE=.028). Therefore, this objective noninvasive measure of RVEF is accurate and reproducible even by non-expert operators, and offers the important advantage of automation.

*Maddahi, et al. Circulation 60: 581-589, 1979.

VENOGRAPHY TECHNIQUE FOR DETECTION OF DVT
Pauline L. Bayer, Harrisburg Hospital, Harrisburg, PA.

Pulmonary embolism is one of the most common causes of death in major trauma and surgical patients. Since the main cause of pulmonary embolization is thrombi arising in the deep venous system of the legs it is imperative that the nuclear medicine technologist be knowledgeable about the lower extremity venous circulation and be familiar with a good venography procedure to aid in the early diagnosis of deep venous thrombosis (DVT).

The purpose of this paper is to present a lower extremity venography technique (performed with Tc-99m Microspheres); and shed some light on the problems encountered during the performance of the procedure and how to circumvent them. The anatomy and physiology of the lower extremity circulatory system will be reviewed along with the presentation of scintiphotos demonstrating various circulatory patterns of normal and abnormal venograms.

With proper technique radionuclide venography for the detection of DVT of the lower extremities is easy to perform, gives minimal discomfort to the patient, and gives good visualization of the iliac veins and the inferior vena cava. (A lung scan is also performed after completion of the venogram without injection of additional radionuclide.)

In our institution we have performed over 500 lower extremity venograms and have found that the scintiphotos obtained with our technique are useful in the assessment of thromboembolic disease in suspect DVT patients.

PHYSIOLOGIC TOMOGRAPHY: A QUANTITATIVE SCANNING TECHNIQUE USING POSITRON COMPUTED TOMOGRAPHY. J. Miller, F. Aguilar, R. Sumida. UCLA School of Medicine, Los Angeles, CA.

As the number of facilities with positron tomographs and medical cyclotron capabilities increases, the Nuclear Medicine Technologist will be increasingly exposed to the use of positron computed tomography(PCT) for the study of human physiology. The purpose of this presentation is to review some of the physical aspects of PCT, that is, annihilation-coincidence detection, attenuation correction and image reconstruction; and to discuss the criteria for the selection and use of labeled compounds in the study of physiological processes such as blood flow, metabolism, etc.

This approach is referred to as physiologic tomography (PT) and has three major requirements. (1) a tomographic imaging device capable of quantitatively measuring tissue radioactivity concentrations in man, (2) labeled compounds that trace physiological process in a known and predictable manner and (3) the use of mathematical models that properly describe the behavior of the labeled compounds in the body and allow the measurement of physiological variables such as blood flow and metabolism from PCT data.

Examples of the use of N-13 ammonia (NH) and (F-18) fluorodeoxyglucose (FDG) for the measurement of blood flow and glucose metabolism in the brain and heart will be shown in patients with stroke, tumor, epilepsy and myocardial infarction and normal volunteers. These studies will be used to illustrate the principles of PT and to contrast this technique to the morphological information provided by x-ray CT.

ANALYSIS OF 1979 NUCLEAR MEDICINE PERSONNEL RADIATION MONITORING DATA. W.L. Robinson, J.J. Merkin, S.E. Skubic, and S.L. Payne. Bionucleonics, Inc., Lancaster, PA.

Data from over 50 hospitals, with 100 technologists sampled, are reviewed for insight into areas for exposure reduction, operational changes, staffing, equipment needs, etc. in light of N.R.C. ALARA philosophy.

Analyses evaluate the differences between departments with and without radionuclide generators, number of technologists per department, number of imaging studies per technologist, imaging room size, and use of Xenon or not.

Any conclusions drawn are purely speculative; however, results do provide insight into areas for concentrated radiation reduction techniques. No attempt has been made to extract the complex interaction of the multiple parameters analyzed.

Location and positioning of film badges and T.L.D.'s were not determined; however, result variability from this parameter is discussed.

The dose reduction implications extend to all nuclear medicine staff not just the technologist. Similar smaller scale evaluations will need to be done annually by all N.R.C. licensees as they pursue their obligations to their adopted ALARA programs. This sampling allows one's interpretation of the results of whole body and extremity badge evaluation to be more meaningful.

MAGNIFICATION SCINTIGRAPHY-IMPROVED DETECTION AND LOCALIZATION OF BONY ABNORMALITIES IN LOW BACK AND HIP PAIN. R. Davis, A. Samuel, N. Papanicolaou, U. Willi, Y. Lanoie, R. Grant and S. Treves. Children's Hospital Medical Center and Harvard Medical School. Boston, MA.

We evaluated magnification scintigraphy for the detection and localization of bone disease in patients with low back and hip pain.

Sixteen consecutive abnormal scintigraphs were evaluated. All had conventional, pinhole magnification scintigraphy; and radiographs. Patients were injected with 200 uCi per Kg. of Tc-99m-methylenediphosponate 3 to 4 hours before imaging. All images were obtained with a Searle LFOV scintilliation camera with ½ inch NaI(Tl) crystal. Images of 500K with the parallel hole high resolution collimator and of 200-300K with the 4mm pinhole collimator were obtained.

Of the 16 patients evaluated all had abnormal scintigraphy; 11 (68.7%) had various degrees of abnormal radiographic findings. Magnification scintigraphy delineated the lesions much better in 14 (87.5%); and abnormal pathology was found only with the aid of the pinhole in 3 (18.7%) cases.

Our work confirms that scintigraphy aids in the early detection of bone disease in patients with low back and hip pain even in the abscence of radiographic abnormalities. The addition of high resolution magnification scintigraphy increases the sensitivity of

the method and improves the localization of the disease. We recommend the use of high resolution pinhole scintigraphy in the routine evaluation of patients referred with low back and hip pain.

OSTEONECROSIS OF THE KNEE: STUDY OF 8 CASES AND REVIEW OF THE LITERATURE. D.S. Conn. Sunnybrook Medical Centre, Toronto, Ont.

The purpose of this study is to review recent cases of osteonecrosis at this centre in order to assess possible etiological factors in this idiopathic disease.

A retrospective review of the records of the last 4 years was carried out yeilding 8 cases of osteonecrosis of the knee.

7 out of the 8 cases were men. The age range was 50 - 68 years. Six of the patients had a classical history with spontaneous onset of knee pain. 6 cases had medial and 2 had lateral knee pain. 3 patients had previous corticosteroid therapy. 2 cases had previous trauma to the knee. 5 patients had histories of congenital or degenerative spinal disease. 3 patients had meniscal tears. 5 cases had cultures of their synovial fluid and all were negative.

In view of the high incidence of torn menisci among these patients, an arthrogram should be considered in cases of negative x-ray and positive scan of the knee. 2 out of the 3 patients who experienced recovery had meniscectomies for torn menisci. Trauma and corticosteroids are secondary causes of osteonecrosis. Meniscal tears can be either a cause or a result of osteonecrosis. Spinal abnormalities may contribute abnormal stress to the knee resulting in osteonecrosis.

My findings will be compared to the current world literature in this area.

QUANTIFICATION OF ASEPTIC BONE NECROSIS IN LUPUS PATIENTS. A.M. Gober, P.O. Alderson, J.J. Conklin. The Johns Hopkins Medical Institutions, Baltimore, MD.

Systemic lupus erythematosis is an autoimmune disorder affecting primarily the body's collagen tissue. It is generally a disease of women between the ages of 20 and 40. Steroids are effective in suppressing inflammation and other disease activity. They may produce undesirable effects, one of which is aseptic bone necrosis. The technique that will be described is a quantification of this process. The patient is given an i.v. injection of 20 mCi of ^{99m}Tc-MDP. Two hours post injection, the patient is imaged in the anterior projection on a gamma camera with a converging collimator. The femoral heads are imaged with inward rotation of the feet. The shoulders and knees are also imaged (symmetrical, paired structures are imaged for the same preset time). The regions of interest are drawn over the femoral heads, humeral heads, femoral and tibular condyles with a corresponding background for each. The number of pixels and total counts are recorded. A mean count is determined for all areas. A target to background ratio is calculated by dividing the mean patient counts by the mean background counts. Normal patients were studied as control values. Patient positioning and selection of the ROI are the critical steps in this procedure. The significant factor in correct ROIs is size. An area too large statistically normalizes small defects. Scatter from surrounding activity results in a higher target to background ratio than the actual value. This procedure has been evaluated for 40 patients with SLE taking steroids.

QUANTITATION OF 24 HOUR SKELETAL UPTAKE OF Tc-99m METHYLENE DIPHOSPHONATE -- A NEW APPROACH. M. Dalisay, P.D. Esser, R.A. Fawwaz, College of Physicians & Surgeons, New York, NY.

Quantitation of the uptake of Tc-99m-diphosphonates (Tc-DP) in the skeleton is used for the detection and monitoring of metabolic bone disease. Whole body counters (WBC) normally used for this purpose are available only at a few centers. In addition, a bone scan is necessary to supplement the WBC to identify urinary retention, urinary contamination and sc infiltration of tracer during iv injection. To circumvent these limitations, we utilized a scanning camera for both whole body counting and imaging. To investigate the appropriateness of the method, the 24 hr skeletal uptake of Tc-DP was determined and compared with results reported for the WBC method.

Eleven subjects free of bone disease were injected iv with 200 uCi/kg of Tc-99-methylene diphosphonate (MDP). Five minutes and 24 hrs later, whole body images and counts were obtained utilizing a moving camera with a single pass collimator. Scan speed was adjusted to 15 cm per minute. The following variables were kept constant for each patient: distance from shoulders to collimator and instrument calibration settings. Background and a Tc-99m standard count were determined also at 5 minutes and 24 hours after MDP injection.

The 24 hr skeletal uptake in our subjects expressed as percent retention per kg body weight, was 0.52 ± 0.074 which is not significantly different from values reported in the literature. The wide availability of scanners and ability to identify artifactual 24 hr skeletal retention are distinct advantages of this method compared to the WBC.

THREE PHASE ORTHOPEDIC BONE SCANNING. N.L.Kelty, L.E.Holder Union Memorial Hospital, Baltimore, Maryland.

Increasing requests by orthopedic surgeons to assist in diagnosing patients with unexplained bone pain, has led to a realization of additional values of bone scanning. Previously bone scans were primarily used to detect metastatic bone disease. However, we have found a three phase bone scan to be a very sensitive and reliable test for the early detection of several acute bone processes. A three phase bone scan can aid in the evaluation of osteoid osteomas, stress fractures, osteomyelitis vs cellulitis, myoclitis ossificans, diabetic foot ulcers, and the status of hip replacements. In addition, it can also evaluate vessel patency and bone viability following the reimplantation of severed fingers.

Bone immediately reacts to stress, infection, surgery and other trauma by forming new bone and remodeling. The skeletal tracer uptake is directly related to the blood flow and the rate of new bone formation, hence the ability of bone scans to detect abnormalities weeks to months prior to radiographic changes.

A radionuclide angiogram is acquired at the time of injection, to determine any blood vessel disease. This is immediately followed by a blood pool(soft tissue) scan, to evaluate infection, hyperemia and tumor vascularity. Three hours later delayed high resolution views are obtained. These images represent the binding of the radioactive bone tracer to the hydration shell around the bone.

By reviewing the three phases of this scan,x-rays, and the clinical symptoms, we feel we are able to give the orthopedic surgeon additional valuable information on his patient's condition.

Wednesday, June 25 — Room 3123
Cobo Hall — 9:30 a.m.-4:00 p.m.

Submitted Papers

Moderator: Janice O. Brewster

IMPROVED HARD COPY IMAGES WITH A COMPUTER DRIVEN VIDEO IMAGE FORMATTER. K.C. Worthington, W.L. Rogers, J.H.Thrall J.W. Keyes, Jr. University of Michigan Medical Center, Ann Arbor, MI.

A high quality computer display when interfaced with a video formatter has been found to produce images superior to analog scintigrams.

A Matrix 1000 Video Image formatter (VIF) (512 x 512 matrix, 256 grey scale levels) interfaced to an MDS A^2 computer has been utilized as an alternative device for hard copy image recording for both clinical and research studies. Over 2500 video scintigrams were obtained covering a number of clinical imaging problems. These scinti-

grams were subjectively evaluated by the clinical staff.

Compared to analog imaging, computer driven VIF appears to have the following advantages: 1. The problem of re-imaging due to technical errors (i.e. incorrect intensities, double exposed film) is eliminated by computer storage of raw data. 2. Computer translation tables offer an ideal means for matching film and VIF response characteristics with completely flexible choice of image grey scales. 4. Computer and VIF can be used to select image sizes and formats best suited for each study. 5. The computer offers versatility for nondestructive image enhancement and filtering. 6. Image graphics are readily added to supplement study information. 7. While using the VIF a greater economy of film cost was realized. 8. Data acquisition visualized on the computer display allows immediate quality control before exposing film.

Computer driven VIF can now be considered a viable alternative for hard copy image recording.

AN EVALUATION OF THREE DIFFERENT PINHOLE APERTURES FOR LARGE FIELD OF VIEW CAMERAS. R.D.Bowen, J.A.Patton, M.V. Kulkarni, E.S.Morgan, and J.J.Touya, VA Medical Center and Vanderbilt University Medical Center, Nashville, TN.

The magnification quality of pinhole collimators for large field of view cameras was evaluated in comparison to the magnification quality of the standard pinhole collimator for small field of view cameras. Resolution and sensitivity were measured for a Picker pinhole collimator using 3.18 mm, 5.49 mm and 9.54 mm aperture diameter inserts, attached to a Dyna Camera 4/15-37 and for a Searle standard pinhole collimator with a 5 mm aperture diameter, attached to a Pho/Gamma IV camera. Measurements for Technitium-99m were performed at 2, 3, and 4 inches from the collimator face using a Searle 4 quadrant bar pattern and a Picker thyroid phantom. Sensitivity was determined by measuring the time required to collect 400 K counts from the thyroid phantom using the Searle collimator as the standard. Best resolution was obtained with the 3.18 mm aperture insert, but its sensitivity was 7 times smaller than the standard. The 5.49 mm aperture insert had slightly worse resolution than the standard Searle pinhole and half its sensitivity. The 9.54 mm aperture insert had considerably worse resolution than the standard, however, its sensitivity was 1.5 times larger. Parameters of these different pinhole inserts should be very well known in order to obtain optimum studies for each imaging situation since their sensitivities and resolutions are significantly different.

FLOOD REPLENISHMENT FOR NUCLEAR MEDICINE FILM PROCESSORS. E.D. Frank, D.A. Wilken, and J.E. Gray. Mayo Clinic and Mayo Foundation, Rochester, MN.

Most radiographic film processors in current use process high volumes of film. This high volume allows the chemicals in the processor to be replaced at a rate such that stable operating levels can easily be maintained and films can be processed at constant base-plus-fog, mid-density, and contrast levels. In many radiology departments the nuclear medicine processor is isolated from the main department and processes a low volume of single-emulsion film. This processing environment will create some difficulty in maintaining a stable developer activity level for the proper development of the film. In addition, films processed in this unstable environment will be processed at high base-plus-fog and mid-density levels, with an associated decrease in contrast.

We describe our experience using flood replenishment, which is a method in which developer starter solution is added to the developer replenisher to form a developer solution in the replenisher tank. This solution is then introduced into the processor at timed intervals--with the use of an interval timing device--independent of the number of films being processed. By this process, a stable level of developer activity is maintained in a processor used strictly to process a low volume of single-emulsion film. Of special importance is that imaging cameras will need little or no adjusting because of the stable processing environment and that films will be of a much higher quality.

UNIFORMITY CORRECTION CIRCUITRY: THE EFFECTS OF EXTRANEOUS ACQUISITION ERRORS. K. Newcomer, D. Chapman, E. Garcia, E. Siegel, M. Brachman, and A. Waxman. Cedars-Sinai Medical Center. Los Angeles, CA.

Since many manufacturers have added uniformity correction circuits (UCC) to their scintillation cameras, it becomes necessary that additional steps be taken to prevent uniformity artifacts. The single most important factor for the technologist to understand is that the UCC is designed to correct nonuniformities intrinsic to the properly peaked system and that it is unable to distinguish them from nonuniformities caused by faulty flood storage. Problems associated with the acquisition of a nonuniform flood field can result in a loss of sensitivity and can introduce artifacts onto a clinical image. Some of the problems of flood storage with a fillable flood phantom include: an unmixed source, bubbles in the source, a phantom with uneven thickness and positioning of a source. Problems associated with point source flooding include: improper distance and positioning of the source, too much activity in the point source, edge packing, and activity from remote sources. Since problems exist regardless of method, we recommend that the following procedure be followed to assure that a uniform flood is acquired: 1) careful preparation of the camera and the flood source, 2) evaluation of the flood source image without uniformity correction, 3) if the image is free of nonuniformities caused by the flood source, store this flood field and evaluate the image of the corrected flood field, and 4) calculate the percent data loss and determine if it is acceptable. We conclude that proper flood storage in UCC equipped cameras is highly dependent upon technique. Following the steps outlined above will significantly reduce image artifacts resulting from extraneous flood field acquisition errors.

THE TRH STIMULATION TEST: IS IT REALLY USEFUL? B.J. Dranbauer and E.L. Nickoloff. The Johns Hopkins Medical Institutions, Baltimore, MD.

Secretion of thyrotropin (TSH) from the anterior pituitary is regulated by thyrotropin releasing hormone (TRH) from the hypothalamus and the negative feed-back effects of thyroid hormones. Intravenous administration of 500 ug TRH will cause increases in TSH levels in normal patients. There is some confusion about the degree of change in TSH levels in normal and abnormal patients, and for that reason, we have studied results of this test in 48 patients. T4RIA and T3U values should be determined on all baseline specimens as an aid to interpretation of the results.

Variations in the response of TSH at baseline, 20 minutes and 40 minutes indicated various thyroid conditions. Results found were as follows:

	Baseline	20 minute	40 minute
Normal	3.7±1.9	24.2±11.4	18.7±10.7
1° Hypothyroid	22.7±15.6	>40	>40
2° Hypothyroid	1.2±0.92	1.3±1.27	1.4±1.27
3° Hypothyroid	5.5±4.43	23.5±18.6	27.7±11.3
Hyperthyroid	2.2±1.06	3.1±1.59	3.1±1.06

This test distinguished well between the above conditions. Blunted TSH response along with normal T4RIA and low T3RIA values were often seen in euthyroid patients with systemic illnesses.

The combination of the TRH stimulation test and the baseline thyroid hormone values can be used to delineate patients with a variety of thyroidal conditions, and is a very helpful addition to the available thyroid assays.

TECHNIQUE FOR DETECTION AND LOCALIZATION OF ACTIVE GI HEMORRHAGE WITH Tc-99m SULFUR COLLOID. A. J. Shipman, Harrisburg Hospital, Harrisburg, PA.

The mechanism of gastrointestinal (GI) hemorrhage in patients with rectal bleeding is considered a challenging and often perplexing problem facing the clinician. Management of acutely ill, unstable patients with massive GI hemorrhage does not permit the luxury of a thorough diagnostic search. An important step in the care of such a

patient is a rapid diagnosis of the location of the bleeding site.

Conventional modalities currently used for GI bleeding assessment are invasive, time-consuming, and have potential patient risk.

This scintigraphic technique using Tc-99m sulfur colloid for detection and localization of active GI bleeding has definite advantages in that it is: 1) simple, 2) sensitive 3) non-invasive and 4) rapidly performed.

A large field of view gamma camera afixed with a high sensitivity, parallel hole collimator is positioned over the patient's lower anterior abdomen. An 8 mCi bolus of Tc-99m sulfur colloid is injected into an antecubital vein. Rapid sequence scintiphotos are acquired every three seconds for one minute. Immediately following the flow study, 500K static images are obtained for twenty minutes. The average time to perform this study is thirty minutes.

In our nuclear medicine department we have found this simple and sensitive technique to be effective and valuable for the detection and localization of active bleeding sites in the bowel.

HEPATIC PERFUSION MAPPING USING Tc-99m MACROAGGREGATED ALBUMIN. M.J. Tuscan, J.H. Thrall, W.D. Ensminger, J.E. Niederhuber, University of Michigan Medical Center, Ann Arbor, Michigan

Patients with advanced liver metastases can benefit from regional chemotherapy by direct infusion into the hepatic artery. Placement of the arterial catheter is critical to insure homogeneous perfussion of the liver by the chemotherapy.

A scintigraphic technique has been developed and used clinically to determine the distribution of flow from the hepatic catheter at the time of surgery. After placement of a catheter into the hepatic artery, 1 mCi of macroaggregated albumin (MAA) is slowly injected through it. A 500K count anterior view of the liver is obtained on a portable gamma camera and digital computer. This image is compared to a previously performed standard Tc-99m sulfur colloid (SO_4) scintigram. If the pattern of distribution of the Tc-99m MAA matches that of the Tc-99m SO_4 the catheter placement is optimal. If the two studies do not match, the surgeon may reposition the catheter and the study repeated. By using computerized image subtraction the new perfusion bed can be determined. Of eight patients studied intraoperatively, to date, an average of three injections per patient were required to obtain optimal catheter placement.

Follow-up perfusion studies during the course of chemotherapeutic treatment are easily performed. The tracer dose is introduced into the hepatic artery catheter and allowed to slowly perfuse the liver. This method offers exact mapping of the perfusion bed by duplicating the infusion of the chemotherapeutic agent.

This agent is more accurate than the previousy used fluorene or radio-opaque dyes to determine flow from indwelling catheters.

SEQUENTIAL SCINTIGRAPHIC EVALUATION OF SPLENIC AUTOTRANSPLANT. C. Park and J. Patel. Thomas Jefferson University Hospital, Philadelphia, Pennsylvania.

Autotransplantation of small fragments of splenic tissue following splenectomy for traumatic rupture of the spleen has been observed clinically. In the splenic autotransplant model, experimental animals splenectomized and a small fragment of spleen is placed either subcutaneously or intra-abdominally producing a situation analogous to splenosis. Following the surgery, the experimental animals were evaluated with sequential scanning of the abdomen to demonstrate splenosis. Immature Sprague-Dawley rats (100 - 200 gm) were used for the study. Splenectomy was performed and 50 to 100 mg of the splenic fragment was implanted into the subcutaneous tissue of the anterior abdominal wall or intra-abdominally. Six weeks following the surgery, each rat was subjected to splenic imaging. Repeat scan was obtained every 4 to 6 weeks thereafter. Our preliminary data suggests; (a) One can see splenic tissue similar to the original organ in about six weeks after the transplantation. (b) In vivo imaging of the transplanted splenic tissue is difficult to demonstrate using Tc-99m Sulfur Colloid since only small amount of splenic tissue can be re-implanted successfully. (c) In vitro analysis following the intravenous injection of Tc-99m Sulfur Colloid revealed good concentration of the radiotracer within the transplanted splenic tissue.

THE TECHNIQUE OF DUAL RADIONUCLIDE GASTRIC SCINTIGRAPHY (LIQUID-SOLID GASTRIC RADIONUCLIDE EMPTYING STUDIES). J. Reilley, G. Applegate, E. Rock, P. Bandini, R.S. Fisher, L.S. Malmud. Temple University Hospital, Philadelphia, PA.

The purpose of this study is to describe a dual radionuclide, liquid-solid gastric emptying study technique. Previous studies used either a liquid or solid meal, or did not relate the dual study results to clinical syndromes. Our technique has been employed to establish a normal range of gastric function quantitatively, and to study of patients with a variety of gastric disorders, including gastric outlet obstruction to liquids and solids, and selective obstruction of solids. The technique has also been applied to the study of gastric emptying in patients treated with various pharmacueticals.

The solid component of the meal consists of chicken liver, labeled with Tc-99m-sulfur colloid in vivo using the technique of Meyer et al. The liquid component of the meal is labeled with Indium-111-DTPA. The rate of emptying of the meal is quantitated using a gamma camera on line to a digital computer. Images are obtained for one minute at 15 minute intervals for up to 3 hours. Data is processed and time activity curves are generated for liquid and solid gastric emptying simultaneously. In addition, patients were studied before and after the use of an anticholinergic drug in order to quantitate the effect on gastric emptying of the pharmaceutical.

This technique appears to be a more sensitive indicator of gastric emptying abnormalities than liquid emptying studies alone, including the saline load test or liquid radionuclide test. Patients with selective delayed emptying of solids are readily detected. In addition, the technique lends itself to the non-invasive study of gastric emptying responses to various pharmaceuticals.

TECHNICAL ASPECTS OF SCANNING FOR GASTROINTESTINAL (GI) BLEEDING WITH 99mTc-SULFUR COLLOID (SC). K. Koch, H. Goldstein, A. Alavi. Hospital of the University of Pennsylvania, Philadelphia, PA.

In the past, determination of the presence and site of active GI bleeding has required invasive diagnostic procedures. Now, scanning with 99mTc-SC offers a noninvasive alternative.

The technique that has been developed at our institution requires no patient preparation. It is available on a 24-hr basis and may be performed in the Nuclear Medicine Laboratory or at the bedside.

The patient is placed in the supine position with his/her abdomen under the detector of the gamma camera (a large field of view camera with Polaroid is preferred). Twelve mCi of freshly prepared 99mTc-SC is administered intravenously.

The persistence scope is used to observe the flow of the radiopharmaceutical and as a positioning guide. The patient is then repositioned for serial 500 K images that include liver edge and pelvis. Subsequently, the patient's position is adjusted in order to image the splenic flexure, lower pelvis and anterior liver. Imaging, searching the abdomen and pelvis, is continued for 30 minutes. If a focus of increased activity is visualized, its transit within the GI tract may be followed. If no focus is seen by 30 minutes, the study is determined to be negative for GI bleeding at the time of injection. The study may be repeated when clinical signs indicate active GI bleeding. Active bleeding may be readily detected by this technique.

TECHNIQUE AND APPLICATION OF RADIONUCLIDE VENTRICULOGRAPHY. N. A. Thompson - Spangler. Milwaukee Children's Hospital, Milwaukee, WI.

Computed tomography has been established as the standard diagnostic modality for examining the anatomy of cerebrospinal fluid (CSF) spaces in children. Some children, however, require the additional evaluation by radionuclide ventriculography (RNV) to determine bulk CSF flow.

The technique of RNV is individualized to the central nervous system abnormality. Tc-99m DTPA and In-111 DTPA are the standard tracers. The CSF spaces are entered directly in infants with open sutures or through a diversionary shunt system when present.

A RETROSPECTIVE LOOK AT THE IN VIVO CROSS MATCH. S.L. Merchant and E.L. Nickoloff. The Johns Hopkins Medical Institutions, Baltimore, MD.

The In-Vivo Crossmatch uses Cr-51 labeled red blood cells to answer the question of whether a patient with severe anemia can be safely transfused with a unit of blood when the blood bank is unable to provide a definitive donor match. It is critical that the donor cells can be labeled with Cr-51, washed and reinfused to the patient in a sterile, pyrogen-free manner, without damage to the erythrocyte. Samples are taken from the patient at 3, 10 and 60 minutes after infusion of the labeled red blood cells.

We have performed this study on 12 patients over the past 3 years. Five of these patients gave no significant difference in the counting rate of the 60 minute whole blood samples from the 3 minute sample, indicating no hemolysis of donor cells. The other 7 patients gave rates which were acceptable (greater than 70% of the administered labeled donor red cells at 60 minutes). Transfusions of the tested blood were given to 9 of these patients and were well-tolerated in 8.

While an acceptable In-Vivo Crossmatch does not assure that the recipient will not reject the donor cells, it is a helpful indication of compatibility in those rare instances when blood banks cannot identify a satisfactory donor.

TECHNIQUE FOR IN VIVO CROSS-MATCHING USING CR-51 LABELED RED BLOOD CELLS. R.L. Warren, C.J. Erickson, T.A. Powers, C.H. Wallas, J.J. Touya. Vanderbilt University Medical Center, Nashville, TN.

In vivo cross-matching can be an extremely useful procedure in patients with unusual antibodies not detected by routine in vitro matching. Because several units of blood may need to be cross-matched before a compatible sample is found, the background level of the tracer (bilirubin, plasma free hemoglobin, radionuclide, etc.) will increase with each test. Since 80%-90% of an incompatible test dose may be hemolyzed by one hour, there will be a significant amount of the tracer released into the plasma. Consequently we sought to devise a procedure which would take into account this serial rise in background while retaining sensitivity. Our technique utilizes Cr-51 labeling of a small quantity of the blood being matched with blood sampling prior to and at 10 and 60 minutes after injection of the labeled cells. By obtaining the hematocrit, whole blood counts, and plasma counts of the patient samples, the percent hemolysis of the injected blood can be calculated. We have performed transfusion when the hemolysis is less than 10%. If this is not the case, a subsequent cross-match is performed using a slightly greater amount of Cr-51 for labeling with identical patient blood sampling. By using the background activity of the plasma and whole blood in the sample prior to the injection, correction can be made for the activity remaining from the previous test. In this manner we have performed as many as four consecutive cross-matches on a single patient before successfully identifying a compatible unit of blood.

A NEW TECHNIQUE FOR WASHING RED BLOOD CELLS. R.L. Warren, C.J. Erickson, T.A. Powers, and J.J. Touya. Vanderbilt University Hospital, Nashville, TN.

Cr-51 labeling of red blood cells requires that all activity be in the red cells themselves with an insignificant amount present in the plasma. In order to accomplish this it is necessary to wash the red cells several times, thus exposing them to possible bacteriologic contamination and mechanical hemolysis. Consequently we sought to develop a labeling procedure which would minimize these risks while maintaining simplicity. Our technique utilizes a single syringe into which the blood to be labeled is drawn. The blood remains in this same syringe throughout the labeling and washing procedure. Ten milliliters of blood is drawn into s syringe containing 2 ml ACD solution and the needle is replaced with a three-way stopcock. A sterile, disposable injection cap is placed over one of the two remaining ports and the third port is covered with the injection cap cover. For labeling, 30 uCi Cr-51 sodium chromate is added through the rubber injection cap followed by 1 ml sterile saline. The syringe is then gently rotated at room temperature for 30 minutes. Six ml of sterile saline is added through the injection port with gentle agitation by hand. The syringe and stopcock are then placed in the specially designed centrifuge cup and spun at 3,000 rpm for 10 minutes effecting separation of plasma and RBC's. Without removing the syringe from the cup, the plasma is drawn off through the injection cap, sterile saline is added via the same route, and the specimen is again centrifuged. This sequence is performed twice and typically results in more than 99 % activity present in the RBC's. In conclusion we believe that this method provides less opportunity for bacterial contamination and decreased RBC mechanical damage.

DIFFERENCES BETWEEN Tc-99m-MDP STABILIZED AND UNSTABILIZED. K.T. Study, K.A. Reed, and D.L. Laven. University of New Mexico, Albuquerque, NM.

A study was undertaken to ascertain whether or not the addition of ascorbic acid was beneficial to the MDP formulation and did not alter its chemical properties. Binding properties to various substrates, biodistributions in mice, and shelf life studies were conducted using Tc-99m-MDP with ascorbic acid and Tc-99m-MDP without this stabilizer.

Partition coefficients or K-values were calculated with both types of MDP in Sephadex, hydroxylapatite, polyacrylamide gel, and Sephacryl. The K-values were significantly different in all cases as determined by the t-test. Tc-99m-MDP with ascorbate had a higher affinity for hydroxylapatite than did MDP without ascorbate. To confirm this higher affinity for hydroxylapatite in-vivo, biodistributions were performed.

A group of Swiss-Webster mice were injected with Tc-99m-MDP-ascorbate and another group injected with Tc-99m-MDP. The mice were sacrificed and organs of interest dissected and counted. Biodistribution calculations indicate that femur/liver, femur/kidney, and femur/blood ratios are significantly greater for Tc-99m-MDP-ascorbate.

This increased skeletal uptake might be due to a difference in renal excretion rates between the two types of MDP, but since Tc-99m-MDP-ascorbate had a higher affinity for hydroxylapatite in-vitro, this is probably not the case. Based on these studies and previous shelf life studies, the authors conclude that Tc-99m-MDP with ascorbate is different and is the agent of choice.

FACTORS WHICH INTERFER WITH THE IN VIVO LABELING OF 99m TC-PYROPHOSPHATE TO RED BLOOD CELLS. N.L. Smith, G. Leitl, M. Kelly, H. Drew, J.Langan and P.O. Alderson. Johns Hopkins Medical Inst. Baltimore, Md.

In a small proportion of patients, undergoing blood pool scans, technically poor studies were found. In an effort to identify the cause,the labeling efficiency of in vivo tagged 99m Tc pyrophosphate (PYP) red blood cells was investigated in sixty patients.

Preparation and injection of the PYP, along with the injection of 99m Tc were carefully controlled. All patients were imaged ten to fifteen minutes after the injection of pertechnetate.

Three tubes of blood were drawn from each patient. The percentages of free and bound pertechnetate were calculated using the following equations:

$$\%free = \frac{\text{plasma counts} \times \text{plasmacrit}}{\text{whole blood cells}}$$

$$\%bound = \frac{(\text{whole blood cells} - (\text{plasma counts} \times \text{plasmacrit})}{\text{whole blood cells}}$$

Eighty-three percent had labeling efficiency greater than 80% and 17% had poor tags (efficiency less than 50%). Poor tagging resulted in blood pool images that had poor cardiac definition and high background counts.

In the group of patients which tagged poorly the following disorders and medications were found: Lupus, transfusion reactions, quinidine and aldomet. Patients with poor tagging traits should be studied with an alternative agent.

COST CONTROL AND THE EFFECTIVE UTILIZATION OF TIN PYROPHOSPHATE FOR HIGH QUALITY BLOOD POOL SCINTIGRAPHY-CAN IT BE DONE? J.W. Fain, I. Mena, LAC Harbor-UCLA Medical Center, Torrance, Ca.

Tin Pyrophosphate (SnPYP) is a well known pharmaceutical for blood pool imaging with Tc-99m pertechnetate. The recommended dose is 0.2 mg/kg body weight and it is supplied in kits containing a total of 15.4 mg, not sufficient for obese patients. We intend to determine the quality of blood pool imaging in obese patients receiving less than 0.2 mg/kg SnPYP, thereby reducing cost if quality remains constant. Patients weighing 88.4 kg or more received one full kit of SnPYP-15.4 mg 30 minutes prior to administration of pertechnetate. These patients received according to body weight between .13 and .17 mg/kg SnPYP intravenously. Patients weighing from 45.8 kg to 72.57 kg received the standard formulation of .2 mg/kg of body weight. Five minutes post injection of the pertechnetate a gated blood pool scintigram in the optimal left anterior oblique projection was done. By minicomputer a region of interest was defined over the left ventricle (LV) and the total counts (cts) were calculated and divided by the number of pixels for normalization. A horseshoe shaped region of interest was placed to calculate LV background and again total cts were normalized. Ratios of target to background (T/B) were calculated for each group of patients. Analyses of the data demonstrated that patients (5) receiving .13 mg to .17 mg SnPYP per kg had no significant change of average T/B ratios as compared to the control group (9) who received the standard .2 mg/kg of body weight. Quantitatively and qualitatively scintigraphy performed on both groups were of equally high quality. Therefore, lesser amount of SnPYP than recommended can be administered with no significant changes in T/B ratios.

A CLINICALLY PROVEN TECHNIQUE FOR THE DETERMINATION OF EFFECTIVE RENAL PLASMA FLOW (ERPF) AND GLOMERULAR FILTRATION RATE (GFR). K. Wilkins, L. Reese, F. Taylor, F.S. Prato, St. Joseph's Hospital and the University of Western Ontario, London, Ontario, Canada.

A reliable technique for the radionuclide determination of ERPF and GFR has been successfully implemented based on accepted two compartment renal clearance models.

Data is acquired using an Anger camera for clinical procedures (6 mCi of Tc-99m DTPA or 500 uCi of I-131 Iodohippurate are injected) or using a single probe counter for sequential determinations often associated with research studies (100 uCi of either Tc-99m or I-131). Prior to injection a background frame is taken and a blood sample drawn. The radiopharmaceutical is injected and data acquired for 50 minutes as 250, 12 second frames. Blood samples are drawn at 30 and 50 minutes post injection. These, along with the blood background sample, are counted in the same geometry used for the determination of initial counts injected.

The time activity heart curve is analyzed using a general purpose program. This curve is corrected for background and radioisotope decay. The program also allows the patient to be repositioned within the first 5 minutes of the study if positioning is inadequate. Through operator intervention the heart curve is fit to a two exponential model employing a least squares curve stripping technique. The curve is scaled to the 30 and 50 minute plasma sample count rates and then determinations of ERPF or GFR along with corresponding volumes of distribution are made.

This method has been used successfully over the last 2 years in 116 patients. The reproducibility of GFR in a group of 9 volunteers (r = 0.93) was excellent.

Technologist Scientific Exhibits

Technologist Scientific Exhibits for the 27th Annual Meeting of the Society of Nuclear Medicine will be located in Cobo Hall. The abstracts for them may be found in the meeting *Program*. Exhibit titles and authors are presented below. They are listed alphabetically by the last name of the first author.

SOLAR PHANTOM: A NEW APPROACH FOR TESTING "CLINICAL RESOLUTION OF NUCLEAR IMAGING DEVICES. K.E. Bingham, T.W. Crucitti, S.M. Gupta and N.E. Herrera. Danbury Hospital, Danbury, CT.

POSITIONING CRITERIA FOR 7 PINHOLE CARDIAC TOMOGRAPHY. J.M. Clare, B. Harkness, J.H Thrall, W.L. Rogers. University of Michigan Medical Center, Ann Arbor, MI.

TECHNETIUM-99m METHYLENE DIPHOSPHONATE (Tc-99m MDP) IN NEURAL CREST TUMORS. E.M. Enger. Milwaukee Children's Hospital, Milwaukee, WI.

EVALUATION OF A MICRO Z UNIFORMITY CORRECTION. M. Madsen, S. Fitzpatrick and K. Bujnowski. Thomas Jefferson University Hospital, Philadelphia, PA.

HEPATIC PERFUSION MAPPING USING Tc-99m MACRO-AGGREGATED ALBUMIN. L.J. Meyers, J. Van Wagner, N. John, M.J. Tuscan, J.H. Thrall. University of Michigan Medical Center, Ann Arbor, MI.

REST/EXERCISE FIRST-PASS RADIONUCLIDE ANGIOCARDIOGRAPHY. R.L. Orr. Methodist Hospital, Indianapolis, IN.

PATIENT CARE: THE RADIONUCLIDE VENTRICULOGRAMS--FOR YOUR INFORMATION. R.E. Thomas. The University of Iowa, Hospitals & Clinics, Iowa City, IA.

RADIONUCLIDE LYMPHOGRAPHY. S.M. Thorpe. Milwaukee Children's Hospital, Milwaukee, WI.

PEDIATRIC NUCLEAR MEDICINE IN A COMMUNITY HOSPITAL. D.F. Wolczak, G. Case, C. Stankiewicz, R.F. Carretta and P. Matin. Roseville Community Hospital, Roseville, CA.

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