

Abstracts: Technologist Scientific Program Fifth Winter Meeting—Orlando, Florida

FRIDAY, 4:30 p.m.—5:30 p.m.

OSCEOLA ROOM

SUBMITTED PAPERS I

Moderator: Christie Burkhead

TECHNICAL ASPECTS AND PITFALLS OF NUCLEAR CYSTOGRAPHY, Ken M. Hinkle. University Community Hospital, Tampa, Fla.

Nuclear cystography is a proven and useful diagnostic procedure in detecting vesicoureteral reflux. The nuclear cystogram presents new concepts for the technologist which can be understood with a good knowledge of the physiology and the technical pitfalls.

Vesicoureteral reflux occurs predominantly in children. Sixty-two patients have presently been studied. Of these patients, only 6 were children. Three of the patients were diagnosed as having ureteral reflux. The nuclear cystogram was performed utilizing 1 mCi of Tc-99m pertechnetate. The radionuclide was introduced into the patient's catheter and followed by 500cc of saline. The cystogram was divided into two phases. The first or filling phase was performed with the patient in a supine position. The second or voiding phase was performed with the patient in an erect position.

Several of the potential pitfalls are: 1) radionuclide interference from previous studies, 2) introducing the radionuclide into the saline bottle instead of the catheter, 3) patient apprehension, 4) improper removal of the catheter, and 5) poor positioning.

The nuclear cystogram can be performed in any nuclear medicine department which has a scintillation camera, once the pitfalls and technical aspects are fully understood.

AN IMPROVED COSTAL MARGIN LIVER MARKER. Michael J. Tschetter. Harry S. Truman Memorial Veterans Hospital, Columbia, MO.

A unique lead strip costal margin liver marker which provides additional information for interpretation of liver scans is described. Most costal margin liver markers currently in use are either uncalibrated lead strips (negative) or line or point sources (positive). The calibrated three cycle marker serves as a standard for assessing the size and anatomical position of the liver and any lesions which may be present. A 500k liver marker view is routinely the first of a series of eight views which comprise a liver/spleen scan in this laboratory. The improved marker is easily and economically fabricated from a one-sixteenth inch thick lead strip 15cm long, 2cm wide, with three 2.5cm long and 1cm deep notches cut along one edge. When properly positioned, this marker enhances the clinical value of liver scans.

CLINICAL AND ECONOMICAL IMPACT OF COMPUTER-ASSISTED DIAGNOSIS IN NUCLEAR MEDICINE. Lance H. Rose. Presbyterian-University Hospital, Pittsburgh, PA.

Computer-assisted diagnosis is becoming increasingly important in routine clinical procedures as well as in research purposes within nuclear medicine departments. Justification for employing a computer for these functions raises the question of the relative degree of improved patient care for the dollars spent. A survey questionnaire developed to answer this question was sent to 115 participants. Results indicate that acquisition of a computer system contributed to the improvement of patient care. However, some disagreement on the usefulness of computer-assisted diagnosis in nuclear medicine still exists. The survey data indicate that the purchase cost

of the computer system and any additional personnel required as a result of the computer in-patient charges can be recovered with a minimal increase in patient charges.

AN ECONOMICAL AND EFFICIENT METHOD FOR RADIOASSAY CALCULATIONS USING A HAND-HELD PROGRAMMABLE CALCULATOR. Stanley K. Lobred, John H. Giga, Cecil N. Bankston Jr., Ancil L. Lindley. Eglin USAF Regional Hospital, Eglin AFB, FL.

Radioassay procedures have been widely adopted by clinical laboratories around the country. Numerous factors such as time available, number of personnel, and budgeting greatly influence the means by which test results are calculated.

Many clinics continue to perform the laborious standard curve preparation and plotting of patient unknowns by hand. Where sophisticated, high cost computers are used they often exceed the needs of the clinic. Efforts in our department to provide an efficient, low cost method of determining radioassay results has led to the use of a commercial hand-held programmable calculator.

We have developed a standard program for each procedure which enables us to readily and accurately compute our results. This has drastically reduced the calculation time, allowing us the capability to perform additional studies and proves to be very economical. In addition, human error due to subjective plotting and intercepting the graph has been eliminated.

The hand-held programmable calculator has proven to be a reliable, cost-effective tool for radioassay data calculation when budgeting and time are primary concerns and assay volumes are low to moderate.

SERUM MYOGLOBIN DETERMINATION: LABORATORY AND CLINICAL EVALUATION. Douglas L. Daniels, Robert E. Sonnemaker, John L. Floyd, William E. Craig, and Robert F. Bode. William Beaumont Army Medical Center, El Paso, TX.

The commercial development of a serum myoglobin radioimmunoassay provides a new parameter in the management of suspected acute myocardial infarction (AMI) patients. We evaluated the laboratory and clinical efficacy of this radioassay. Coefficient of variance analysis of precision between reagent lots, control values, and technologists averaged 5% or less. Multiple serum myoglobin levels were obtained in the first twelve hours on 44 consecutive patients after admission to the Coronary Care Unit. Results were correlated with the final impression based on clinical presentation, electrocardiographic changes, and serum enzyme levels including CK-MB. Myoglobin from patients without evidence of AMI ranged between 0 and 80ng/ml (mean 27.3; SD 17.0). The minimal elevated value in patients diagnosed as having AMI (176ng/ml) was 8 standard deviations above the normal mean value. All patients with AMI demonstrated myoglobin increase at 4 hours. In over half of these patients, myoglobin elevation preceded CK-MB elevation by 4 to 44 hours. One patient without standard criteria for AMI had myoglobin elevation. Chi Square analysis demonstrated equivalence between myoglobin levels and clinical impression. Radioimmunoassay for serum myoglobin is a reliable method for early measurement of AMI.

CORRELATION BETWEEN SERUM THYROXINE LEVELS AND WHOLE BLOOD FILTER PAPER THYROXINE LEVELS. Christine A. Auerbach and Edward G. James. Washington Hospital Center, Washington, D.C.

A recent advance in both radioimmunoassay and postnatal care has been the development of filter paper whole blood

testing capabilities and the introduction of a thyroxine screening test for neonates. The study validates the accuracy of such filter paper measurements. Capillary whole blood is normally used in neonatal thyroxine screening procedures. However, since venous whole blood was easier to obtain, it was used in the study after a positive correlation between venous and capillary whole blood thyroxine levels was shown. In each of forty-four subjects, two different blood thyroxine determinations were made: venous serum and venous whole blood. Results of the serum thyroxine determinations by a commercially available solid phase assay are used as the reference values in testing the accuracy of a newly available whole blood filter paper test. No statistical difference between the two assays was demonstrated. This implies relative equivalence of the two methods and that the whole blood filter paper thyroxine assay is a valid neonatal screening procedure for congenital hypothyroidism.

FRIDAY, 4:30 p.m.-5:30 p.m. SPACE COAST ROOM

SUBMITTED PAPERS II

Moderator: John Reilley

COMPARISON OF XENON VENTILATION WASHOUT IMAGING TECHNIQUES. Joseph F. Wilson, Bruce R. Line, and Gerald S. Johnston. National Institutes of Health, Bethesda, MD.

This study was undertaken to determine which is the more sensitive indicator of regional ventilation abnormalities in xenon washout images: prolonged tracer retention in "fixed time" exposures or heterogeneous clearance patterns in "fixed count" exposures.

Washout data was computer reconstructed into series of fixed time and fixed count images. Functional images of clearance times, obtained from exponential equation fitting of regional time-activity curves, served as the standard for determining the sensitivity of the two imaging techniques. Normal and abnormal patients were compared by computing the mean and standard deviations of volume weighted clearance time distributions.

The mean clearance time could not be used to separate normal from abnormal patients, because it was shown to be dependent on the frequency and depth of respiration. Further, since disappearance time depends on equilibrium count rate which could not be fixed, no single intensity could be established for fixed time images to separate normal and abnormal lung regions. Exposure in fixed count images was shown dependent on differences in clearance time and therefore regions of prolonged tracer retention are highlighted. The fixed count images more closely reflected the heterogeneous distribution of clearance times in the functional images of abnormal patients.

These comparisons suggest that fixed count images are more sensitive for detection of delayed tracer clearance associated with abnormal regional ventilation.

PERFORMANCE OF ROUTINE RADIONUCLIDE VENOGRAPHY IN CONJUNCTION WITH PERFUSION LUNG IMAGING. Jeffrey R. Shewmaker and Sheri L. Pasternak. Penrose Hospital, Colorado Springs, CO.

Pulmonary embolus is a major cause of death in hospitals of the United States each year. Testing for emboli, as well as their possible origin in the legs, is a simple procedure when a venogram is combined with a perfusion lung study. A mere change in injection site of the radiotracer from an anticubital vein to dorsal veins of the feet can provide significantly more information about the patient. This is especially true in those instances of deep vein thrombosis when the patient is asymptomatic. Until recently, searching the deep veins for thrombophlebitis was a difficult technique. Contrast venography requires physician participation, often causes high morbidity and compli-

cations to the patient, and occasionally induces thrombophlebitis. However, radionuclide venography is a relatively easy procedure to perform, is successful in identifying areas of blockage and thrombosis, and is almost painless to the patient.

In a one year period, our hospital performed 151 venogram/perfusion lung scan combinations. Of the 151 scans, 41 were positive for pulmonary embolus and 61 were positive for deep vein thrombosis. Of the 61 positive for thrombosis, 36 did not reveal evidence of pulmonary embolus.

For these reasons we feel venograms should be included on a routine basis in lung imaging whenever possible. They require approximately 15 minutes of additional time and the information they can provide is invaluable.

FUNCTIONAL EJECTION FRACTION IMAGING USING A DIGITAL COMPUTER. Jane M. Neill, Joshua Wynne, and B. Leonard Holman, Departments of Radiology and Medicine, Harvard Medical School and Peter Bent Brigham Hospital, Boston, MA

Noninvasive techniques for the evaluation of left ventricular function are gaining widespread popularity in the evaluation of patients with cardiac disease. In order to determine the validity of the radionuclide left ventriculogram, 38 patients were studied within 24 hours following cardiac catheterization. We also evaluated left ventricular function in 20 patients within 24 hours following an acute myocardial infarction. Each patient was studied with a gamma camera interfaced with a gate synchronized digital computer. Blood pool visualization was achieved by the in vivo labelling of red blood cells with Tc-99m pertechnetate. A 35° left anterior oblique view was obtained using a slant hole collimator. Ten million counts were obtained in frame and matrix form. End diastolic and end systolic images of the left ventricle were obtained. From this information functional images of ejection fraction, stroke volume and paradox were created.

The results of the radionuclide ventriculogram were compared to the results of the cardiac catheterization. Global ejection fraction obtained with the radionuclide technique was within 10% of the ejection fraction obtained at cardiac catheterization in 31 of 38 patients (82%). Of the 20 patients with acute infarcts, 18 (90%) had evidence of abnormal ventricular performance on the ejection fraction image.

Functional images of the left ventricle provide a sensitive means of evaluating regional ejection fraction in patients with abnormal myocardial contraction.

REPRODUCIBILITY OF EJECTION FRACTION DETERMINATIONS USING THE GAMMA/COR RCG-TM CARDIAC PROBE. John L. Floyd, Robert E. Sonnemaker, Jerome A. Waliszewski, and Robert F. Bode. William Beaumont Army Medical Center, El Paso, TX.

The need to simply and reliably determine ejection fraction at the bedside has become clinically evident. An investigation was undertaken to validate a technique that fulfills this need using the Gamma/Cor RCG-TM Cardiac Probe. Fifteen patients undergoing cardiac catheterization were studied with serial bolus injections of 1.0 to 1.5mCi Tc-99m sulfur colloid. The cardiac probe was positioned over the precordium after localization of the centroid of the left ventricle using time-motion mode echocardiography. The following five determinations were obtained: 1) central injection using echo position; 2) central injection using a more appropriate probe position based on inspection of first radiocardiogram; 3) central injection after probe had been moved away from patient and repositioned; 4) peripheral injection (arm vein) without moving probe; and 5) repeat peripheral injection. Thus it would be determined whether measurement differences existed with injection site, repositioning and rapid serial injections. Correlation coefficients for these measurements ranged between .92 and .98. Mean values for all injection groups differed by only one percentage point. Correlation coefficient with ejection fraction estimated by single plane ventriculography was .87. It is concluded that the Gamma/Cor RCG-TM Cardiac Probe will easily and reliably provide serial ejection fraction measurements.

SINGLE INJECTION THALLIUM-201 STRESS AND REDISTRIBUTION MYOCARDIAL PERFUSION IMAGING: COMPARISON WITH STRESS ELECTROCARDIOGRAPHY AND CORONARY ARTERIOGRAPHY. Jerome A. Waliszewski, Robert E. Sonnemaker, John L. Floyd, Robert F. Bode, Melvin J. Spicer and Martin L. Nusynowitz. William Beaumont Army Medical Center, El Paso, TX.

The efficacy of single injection Thallium-201 (Tl 201) exercise stress and rest redistribution imaging in detecting myocardial ischemia was evaluated by comparison with coronary arteriography (CA) in 36 consecutive patients and with stress electrocardiography (ECG). The Tl 201 studies were interpreted blindly for stress perfusion defects using an analog contrast enhancement technique. Stress ECG was interpreted at two levels of sensitivity: ST depression > 1 mm (abnormal - diagnostic

of ischemia); and nonspecific ST-T changes (abnormal but non-diagnostic). CA was classified as abnormal if at least one of the three major coronary arteries showed a 70% or greater reduction in diameter (27 of 36 patients). Tl 201 results (31 abnormal, 5 normal) showed a highly significant association with those of CA ($\chi^2 = 13.1$, $p < .001$); sensitivity = 100%; specificity = 56%; positive predictive value = 87%; negative predictive value = 100%. By contrast, stress ECG (5 normal, 18 indeterminate, 13 abnormal) showed no association with CA ($\chi^2 = 4.00$, NS); sensitivity = 44%; specificity = 89%; positive predictive value = 92%; negative predictive value = 35%. Thus, single injection Tl 201 myocardial perfusion imaging provides a significant improvement in non-invasive diagnostic evaluation of coronary artery disease.