

## ABSTRACTS OF CURRENT LITERATURE

**Anthracycline Cardiotoxicity: Clinical and Pathologic Outcomes Assessed by Radionuclide Ejection Fraction.** J. L. Ritchie, J. W. Singer, D. Thorning, S. B. Sorensen, G. W. Hamilton; Veterans Administration Med. Ctr., Univ. of Washington, Seattle, WA. *Cancer* 46: 1109-1116, 1980

Following the injection of 25 mCi of technetium-99m PO<sub>4</sub>, radionuclide ejection fractions were determined in 36 patients who had received high doses of anthracycline agents. A depression of the ejection fraction was observed in eight of these patients at 3 wk following drug administration. Of these, half showed evidence of congestive heart failure and two died in congestive failure. The predictive value of radionuclide ejection fractions obtained before drug administration should be carefully weighed in predicting cardiotoxicity.

**Gated Radionuclide Angiographic Evaluation of Valve Regurgitation.** E. W. Bough, E. H. Gandsman, D. North, R. S. Shulman; Providence, RI; *Am J Cardiol* 46: 423-427, 1980

In 22 patients with aortic and/or mitral valve regurgitation but without right-sided regurgitation or intracardiac shunts, and 18 patients without valvular disease, gated angiography using in vivo technetium-99m pyrophosphate labeled red blood cells was performed. The left-to-right stroke volume ratios (SVR) were determined, and a regurgitant fraction (RF) calculated. Normally the SVR should approximate 1.0. These data were compared with data obtained by cardiac catheterization of both chambers.

The mean SVR in control patients by gated radionuclide angiography was  $1.08 \pm 0.06$  (s.d.) and by catheterization data  $1.00 \pm 0.08$ . In patients with regurgitant left-sided valve disease, the SVR determined by radionuclide studies and cardiac catheterization correlated well. Twenty-one of 22 patients with valvular disease had an elevated SVR. Gated radionuclide techniques were more sensitive than catheterization techniques when quantitative methods were used. Comparison of RF by radionuclide study and quantitative catheterization as well as with graded-score cineangiographic study was good. Radionuclide angiography might provide a noninvasive technique with which to determine the hemodynamic significance of regurgitant left-sided valvular disease.

**Effect of Coronary Collateral Circulation on Regional Myocardial Perfusion Assessed with Quantitative Thallium-201 Scintigraphy.** B. C. Berger, D. D. Watson, G. J. Taylor, L. R. Burwell, R. P. Martin, G. A. Beller; Thomas Jefferson Univ. Hosp., Philadelphia, PA. *Am J Cardiol* 46: 365-370, 1980

One hundred and twelve patients with known or suspected coronary artery disease were evaluated electrocardiographically, by coronary angiography, and quantitative thallium-201 scintigraphy. Of these, poststress thallium studies were performed in 77 patients, 62 of whom had angiographic evidence of 50% or greater stenosis of one or more coronary arteries, and 15 of whom had normal coronary arteries. Thirty-five patients were similarly studied at rest. A segmental analysis was used.

In stressed patients, there was no significant difference in the

distribution of thallium-201 in regions supplied by collateral vessels where Q waves were evident. In areas without Q waves but with collateral circulation, abnormal (diminished) thallium uptake was observed.

Studies at rest indicated a greater uptake of thallium in non-jeopardized segments supplied by collateral circulation than in jeopardized segments. At rest, collateral vessels may enhance perfusion of the myocardium. Exercise hypoperfusion is not protected against by the development of collateral circulation.

**Detection of Coronary Artery Disease in Asymptomatic Aircrew Members with Thallium-201 Scintigraphy.** G. S. Uhl, T. N. Kay, J. R. Hickman, M. A. Montgomery, G. M. McGranahan; USAF, Div. of Aerospace Med. Brooks AFB, TX. *Aviation, Space, and Environ Med* 51: 1250-1256, 1980

One hundred and thirty asymptomatic male patients with serial electrocardiographic abnormalities either at rest or induced by stress were studied by angiography and thallium-201 scintigraphy. Standardized treadmill exercise was employed and almost all patients attained 85% of age-adjusted maximal heart rate responses. One minute prior to the termination of exercise, 2 mCi of thallium-201 were injected intravenously and within 6 min an anterior and three LAO views were obtained over the region of the heart using a scintillation camera with a high-sensitivity collimator. Each view was obtained by collecting counts during a period of 6 min, which yielded 500,000 to 700,000 counts per field of view. Delayed images were also obtained. Multigated imaging at a rate of 15 msec per frame was also done and computer stored and processed.

Patients were divided into three groups on the basis of findings at angiography. Of 96 patients with normal coronary arteries, four had abnormal scans (thallium deficit in an area of myocardium). These "false-positive" scans revealed diminished thallium uptake in the inferior-septal wall in the 22° LAO projection in three patients and in the septum on the 45° LAO view in one. No purely inferior or anterior wall "false-positive" scans were seen.

Of 12 patients with minimal coronary artery disease (<50% narrowing in a single artery) eight had abnormal and four had normal scans. All 22 patients with significant (>50% narrowing) coronary artery disease had abnormal scans.

A normal thallium-201 myocardial scan accurately rules out significant coronary artery disease. Myocardial imaging provides a safe, noninvasive method for the detection of asymptomatic coronary artery disease in populations where annual examinations to ensure occupational-medical safety are essential. In addition, they could be useful in monitoring therapeutic regimens.

**Unsuspected Costo-vertebral Fractures Demonstrated by Bone Scanning in the Child Abuse Syndrome.** F. W. Smith, D. L. Gilday, J. M. Ash, M. D. Green; The Hospital for Sick Children, Toronto, Canada. *Pediatr Radiol* 10: 103-106, 1980

Bone scanning with Tc-99m methylene diphosphonate (MDP) is more sensitive than skeletal radiography in the diagnosis of small, unsuspected fractures and delivers a much smaller radiation dose

to the patient. This presentation describes four cases of clinically unsuspected costovertebral fractures encountered in an ongoing prospective study of the use of bone scanning in the traumatized child. In all four cases the children were presented with a history of minor trauma to an extremity or to the head. Total body bone scans revealed, in addition to fractures at the site of the alleged trauma, multiple recent costovertebral fractures. The appearance of the costovertebral fractures on the bone scan is characteristic, with markedly increased activity localized to the posterior ends of the ribs. The bone scan provides a sensitive method of detecting this unusual type of paravertebral injury, which may not be suspected clinically or demonstrated on routine chest radiograph.

**Scintigraphic Evaluation of the Skeleton in Multiple Myeloma.** H. W. Wahner, R. A. Kyle, J. W. Beabout; Mayo Clinic, Rochester, MN. *Mayo Clin Proc* 55: 739-746, 1980

Twenty-seven patients with multiple myeloma and 99 patients with prostatic carcinoma were evaluated roentgenographically and scintigraphically for the presence of early and subsequent bone lesions at 6-mo intervals for periods of up to 5 yr. An attempt was made to identify bone lesions that might account for bone pain as well as to document the extent of bone involvement. From 15-20 mCi of Tc-99m (Sn) HEDP were injected intravenously, and scintigrams were obtained 2-4 hr later using a rectilinear or a whole-body scanner. Only areas that had been the subject of investigation by both modalities were compared, the studies having been conducted within a week's period of time from one another.

In patients with multiple myeloma, roentgenographic studies were more sensitive and specific in identifying bone lesions initially and in identifying lesions in areas of bone pain. Of 243 roentgenograms obtained at the time of initial visit, 30% were abnormal compared with 8% of accumulated scintigrams. Twenty-five sites of pain were roentgenographically abnormal in 21 instances compared with eight by scintigraphy. More than twice as many areas of bone pain were abnormal roentgenographically than scintigraphically at follow-up study. Scans for the detection of skeletal lesions in patients with prostatic carcinoma were superior to roentgenographic studies.

**Scintigraphic Identification of Bleeding Duodenal Varices.** H. D. Royal, N. Papanicolaose, M. Bettman, B. J. McNeil; Harvard and Peter Bent Brigham Hospital, Boston, MA. *Am J Gastroenterol* 74: 173-175, 1980

This report emphasizes the usefulness of radionuclide techniques in the identification of gastrointestinal bleeding sites and the need for correlation of these studies with modalities other than angiography. A cirrhotic man with gastrointestinal bleeding could not be investigated by fiberoptic gastroscopy. A radionuclide blood-pool scan using in vivo pyrophosphate (PPI) labeled red cells tagged with Tc-99m showed a focal area of increased activity in the region of the duodenum at 20 min after injection. Celiac, superior, and inferior mesenteric angiography failed to demonstrate an active bleeding site. Laparotomy revealed a bleeding duodenal varix in the location demonstrated scintigraphically. Unlike sulfur colloid, Tc-PPI-labeled red cells show no preferential uptake by the liver or spleen that might obscure bleeding sites near these organs. The labeled red cells are not rapidly cleared from the blood, permitting progressive accumulation of activity at the bleeding site. The limitations of angiography in the diagnosis of variceal bleeding must be appreciated when radionuclide techniques are evaluated.

**The Use of Radioactive Phosphorus (<sup>32</sup>P) in the Diagnosis of Ocular Tumors.** B. Goldberg, G. B. Kara, L. Previte; New York Eye

and Ear Infirmary, New York, NY. *Am J Ophthalmol* 90: 817-828, 1980

Malignant ocular tumors can be detected by their uptake of P-32. Forty-eight hours after the intravenous administration of 500  $\mu$ Ci of P-32 as a sterile solution of isotonic sodium phosphate, several 1-min counts are taken over the area of a lesion as well as over a control area using a small Geiger-Muller eye probe. The probe is positioned with the aid of a rate-meter. Anterior lesions are counted by placing the probe in contact with the conjunctiva or cornea, whereas posterior uveal lesions are counted using a tranconjunctival approach. The percent uptake is determined by the formula,

% uptake of P-32

$$= \frac{\text{counts/min lesion} - \text{counts/min control}}{\text{counts/min control}} \times 100$$

An uptake greater than 65% at 48 hr is considered a positive result.

Three hundred eighty-nine cases were studied, of which 204 had positive results (two were false positive) and 185 had negative results (12 were false positive). Thus, the overall incidence of error was 3.6%, with a 6:1 predominance of false-negative results.

When the clinical impression was compared with the results of the P-32 uptake test, an error rate of 19.2% against 3.6% was observed. Only for lesions of the ciliary body were clinical and P-32 test error rates the same—at 21%—and were the highest for any region of the eye.

**Peritoneal Mesothelioma—CT, Sonography, and Gallium 67 Scan.** J. Dach, N. Patel, S. Patel, J. Petasnik; Rush-Presbyterian-St. Luke's Medical Center, Chicago, IL. *Am J Roentgenol* 135: 614-616, 1980

This is the first reported case of gallium uptake in a peritoneal mesothelioma. The patient, a 61-year-old white, male, sheetmetal worker with possible past exposure to asbestos fibers, was admitted because of abdominal pain and distention. An ultrasound examination of the abdomen revealed a pattern suggestive of ascites, but there was no acoustic enhancement of the sound beam. CT showed apparent ascitic fluid throughout the abdominal cavity, but the mean density was +14 CT units compared with values of  $0 \pm 4$  CT units for a water phantom. A gallium scan showed increased uptake in both flanks extending upward to the inferior surface of the diaphragm, over the dome of the liver and surrounding the spleen. Increased activity was also seen deep within the pelvis. Exploratory laparotomy revealed a diffusely infiltrating tumor throughout the abdomen, and biopsies showed primary peritoneal mesothelioma. The authors note that the gallium scan findings in peritoneal mesothelioma closely resemble those seen in diffuse peritoneal inflammatory disease.

**Radioimmunoassay for Human Growth Hormone Using Monoclonal Antibodies.** P. G. Bundesen, R. G. Drake, K. Kelly, I. G. Worsley, H. G. Friesen, A. H. Sehon; Univ. of Manitoba, Winnipeg, Canada. *J Clin Endocrinol Metab* 51: 1472-1474, 1980

Polyclonal antibodies (PaB), routinely used in radioimmunoassay (RIA) of polypeptide hormones, have limitations due to the unique characteristics of sera from individual animals and the finite quantity of antisera that each animal can produce. Monoclonal antibodies (MAb) to human growth hormone (hGh), produced by fusion of spleen cells from hGh immunized mice to P3-X20 mouse myeloma cells, were produced in cell culture supernates and in ascitic fluids. Ascitic fluid generation enhanced the antibody titers by 5820X on the average. MAb from clones showing the highest sensitivity to hGh generally exhibited equal to moderate

cross-reactivity with human placental lactogen (hPL); clones with low sensitivity displayed minimal hPL cross-reactivity. Human serum samples from both normal and hGH-deficient patients were assayed by RIA using both PAb and MAb. Correlation with PAb was excellent for results obtained with MAb from three of four clones. The failure of one clone to produce MAb with high sensitivity may be due to failure of that particular MAb to reorganize variants and fragments of hGH. Clinically useful RIAs for polypeptide hormones may be developed utilizing MAb.

**Radiometric Detection of Mycobacteria in Routine Blood Cultures.** W. Landau, J. Feczko, R. L. Kaplan; Rush-Presbyterian-St. Luke's Medical Center, Chicago, IL. *J Clin Microbiol* 12: 477-478, 1980

Two cases are reported in which *Mycobacterium chelonae* subsp. *abscessus* was isolated from routine blood cultures using a semi-automated radiometric system, BACTEC. From each of these immunocompromised patients, the organisms were found in the aerobic bottles only, and only where the BACTEC readings were taken on Day 6 following inoculation. BACTEC readings in the first case, with 12 of 17 blood cultures positive for this organism, ranged from 37-57, average 44 (positive levels). The second patient's cultures gave BACTEC readings of 35-55. Gram stains from positive aerobic blood culture bottles yielded gram-positive rods with an unusual beaded, moth-eaten appearance, which proved to be acid-fast by the Ziehl-Neelsen and fluorescent strains. Subcultures of the organisms on chocolate agar produced colonies only after 72 hr incubation. This represents the first report of radiometric detection of a *Mycobacterium* sp. by utilizing routine blood culture medium. The organisms would not have been detected by blood culture methods that rely on visible changes in the cultures and briefer incubation of subcultures.

**On the Potential Use of Stimulated Positron Emission (SPE) in the Detection and Monitoring of Some Bone Diseases.** M. Benjamin, A. Macovski; Stanford University, Palo Alto, CA. *Med Phys* 7: 112-119, 1980

The authors have studied the feasibility of a new method of measuring in vivo bone mineral content. A thin beam of high energy x-rays irradiate a body part of interest. Some of the photons undergo pair production and the resulting annihilation photons are detected and counted by two position-sensitive detectors of opposite sides of the irradiated slice. Since the pair production cross-section depends on the square of the atomic number, the result will strongly depend on the amount of bone mineral present. Because only a thin slice is irradiated, a direct, three-dimensional image may be obtained without any computer reconstruction. Thus, counts from tissue outside the bone may be excluded. Using radiological models for osteoporosis and osteomalacia, the authors showed that a high sensitivity to small changes (5%) in mineral content of cortical bone could be obtained with a relatively low radiation dose (<0.5 rad). With the same dose, the method is less sensitive to changes in vertebral bone. The dependence of sensitivity on incident x-ray energy was studied, and it was shown that the optimum energy for maximizing sensitivity while minimizing the loss of spatial resolution due to positron range is 2-3 MeV.

**Technetium-99m Labeled Mouse-Spleen Leukocytes: Radiolabeling Parameters-II.** G. L. Dettman, S. M. Wilbur and B. L. Vandenburg; University of California, Irvine College of Medicine, Irvine, CA. *Int J Appl Radlat Isot* 31: 217-222, 1980

Previous work by the authors demonstrated that Tc-99m labeling efficiency for mouse-spleen leukocytes is dependent on the concentration of cells and on the concentration of stannous chloride

used to reduce the technetium. This paper describes the influence of several additional parameters on cell labeling efficiency, as measured by the fraction of activity that is retained on glass-fiber filters after washing and vacuum filtration. The addition order of the reactants was found to be critical. Incubation of the sodium pertechnetate and stannous chloride together before the mouse-spleen cells were added dropped labeling efficiency from 40-50% to 10-15%. Silica gel chromatography with three different solvents showed that the reaction products formed differ according to whether the cells are present before or after combining the pertechnetate and stannous chloride. Purging the buffered cell solution with N<sub>2</sub> gas before the addition of the other reagents was found to increase the efficiency of cell labeling. Higher labeling efficiency was also demonstrated at a lower pH than the value of 6.9-7.0 previously used. However, it is not known if the lower pH would have any effect on the function of the cell in vivo. It is conjectured that the influence of pH probably is related to a difference in the valence state of the Tc-99m.

**Long-Term Clearance of Iodine from the Thyroid.** J. C. Wideman, E. R. Powsner, P. S. Plato; V. A. Medical Centre, Allen Park, MI, Michigan State University and University of Michigan. *Int J Appl Radlat Isot* 21: 375-377, 1980

Few reports on the long-term retention of iodine in thyroid exist. Such information is of value in dose estimation after exposure to long-lived iodine isotopes such as I-129 (physical half life  $1.57 \times 10^7$  yr). This study examined 27 individuals for periods of up to 500 days following administration of I-125 for diagnostic studies. Thyroid counting was performed using both a single NaI(Tl) detector 25 cm from the neck and two detectors in close coincidence to the gland. The results were analyzed by a weighted least-squares fit to a multicomponent exponential function. The mean biological half-life was found to be 113 days with a range of 61-251 days. In no case was a second compartment with a longer biological half-life than the principal component identified.

**Cadmium Telluride Matrix Gamma Camera.** J. D. Allison; Medical College of Georgia, Augusta, GA. *Medical Phys* 7: 202-206, 1980

An experimental gamma camera was designed, constructed, and tested. The gamma camera used a 5 x 5 matrix of cadmium telluride (CdTe) detectors, which were each 2 x 2 x 2 mm in size. The collimator consisted of 1-in. long tantalum tubes with square holes (3 mm center-to-center spacing) and a septal thickness of 0.008 in. A unique feature of this camera was that each detector was located within a separate collimator hole rather than behind it, and this allowed a considerable reduction in detector-to-detector scatter. Each row and column of detectors fed a one-stage amplifier, and a coincidence of row and column pulses provided a direct digital location of the gamma ray. Only threshold pulse-height analysis was used. A microcomputer controlled the image collection, correction, and subsequent display through a videographic interface. Performance measurements were made using line sources at the surface of the collimator. Equal strength lines of 1 mm diameter were clearly resolved at line separations greater than twice the collimating tube dimension. Quantitative sensitivity measurements were hampered by detector problems. These problems, variation in photopeak pulse height and rapid detector degradation, were the major limitations on performance. The author feels that the availability of large numbers of improved small detectors would make a high-resolution, high-sensitivity camera clinically feasible.

**Cholecystoconography in Diagnosis of Cholelithiasis—Pathologic and Radiographic Correlation.** Wenzel Vas, Shia Salem; Henderson

**General Hospital and McMaster University Medical School Hamilton, Ontario, Canada. *J Can Assoc Radiol* 31: 116-119, 1980**

Comparison of ultrasound and oral cholecystography in 140 patients in whom surgical proof was available demonstrated an accuracy of 95% for ultrasound as compared with 96% for oral cholecystography. Gravity dependent shadowing opacities were 100% accurate for the diagnosis of gallstones. Nonvisualization of the gallbladder with acoustic shadowing in the gallbladder bed indicated stones in 94% of cases. Nonshadowing echoes within the gallbladder lumen were associated with stones in only 59% of cases but with gallbladder disease in 96%. The authors recommend cholecystosonography as the initial study in clinically suspected cholelithiasis. They suggest that oral cholecystography be reserved for cases in which the cholecystosonogram is equivocal. Representative sonograms are provided.

**Biliary Cystadenomas: Sonographic-Angiographic-Pathologic Correlations.** M. E. Forrest, K. J. Cho, J. J. Shields, J. D. Wicks, T. M. Silver, T. L. McCormick; University of Michigan, Ann Arbor, MI. *Am J Roentgenol* 135: 723-727, 1980

Three cases of biliary cystadenoma are presented. They demonstrate features common to this histologic type of neoplasm elsewhere. A largely cystic mass with multiple internal septations is characteristic occasionally with either scattered low-level internal echoes forming a fluid level or capillary growths within. Sonographically, the morphology is similar to cystadenoma and cystadenocarcinoma occurring within ovary and pancreas. Clear distinction between benign and malignant processes is not possible preoperatively. Angiography demonstrates a hypovascular mass with a faint rim of contrast material in the wall or septum. Differential diagnoses include congenital hepatic cysts, echinococcal cysts, abscesses, hematomas, cystic hamartomas, and other necrotic neoplasms. Differential diagnostic features are discussed. Sonograms, angiograms, and pathologic correlation are provided.

**Abdominal Staging of Testicular Tumors Using Ultrasonography and Computer Tomography.** R. D. Williams, S. B. Feinberg, L. C. Knight, E. E. Fraley; University of Minnesota, Minneapolis, MN. *J Urol* 123: 872-875, 1980

Thirty-six patients with testicular tumors, who subsequently underwent surgical removal and pathologic examination of retroperitoneal lymph nodes, were studied by ultrasonography,

computer tomography, or both, and these methods were found to be equally satisfactory in the evaluation of retroperitoneal involvement by such tumors. Overall accuracies were similar, with 87% for computed tomography and 81% for ultrasonography, and sensitivities were 93% in both. The specificity of computed tomography was substantially higher at 82% than the 57% evinced by ultrasound. The accuracy of ultrasonography, particularly in evaluating the primary landing site for metastases from testicular tumors, is thought to be equal to or greater than that of lymphangiography. The authors caution that nodes less than 1.5 cm in diameter should not be interpreted as containing tumor as the false-positive rate increases substantially. The combination of computed tomography and ultrasonography apparently offered no appreciable advantage over either study alone. Despite a definite advantage of computed tomography, availability and cost factors may favor ultrasonography in certain cases. Either method is considered appropriate in evaluation of the retroperitoneum in patients with testicular tumors.

**Intrauterine Contraceptive Devices: Evaluation by Sonography.** P. W. Callen, R. A. Filly, T. P. Munyer; University of California, San Francisco, CA. *Am J Roentgenol* 135: 797-800, 1980

Ultrasound was found to be highly effective in the identification of intrauterine contraceptive devices, displaying posterior acoustic shadowing in 90% of patients, type specific morphology in 94% of patients with Lippes Loops, and 81% in those with Copper 7 devices. Entrance-exit reflections were identified in 65% of cases as well. In a separate examination of 200 cases of women without contraceptive devices, posterior acoustic shadowing was never seen secondary to the endometrial cavity reflection alone. The presence of shadowing is, therefore, a valuable aid in identification of the IUD. Knowledge of the specific type of IUD is of considerable value also. The parallel lines referred to as entrance-exit reflections, though not proven, are thought to represent reflections from both anterior and posterior interfaces of the IUD. Recognition of the halo of sonolucent endometrial mucosa surrounding the IUD is helpful in localizing the device to the endometrial cavity itself, and this was found possible in 72% of the cases examined.

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