ABSTRACTS OF CURRENT LITERATURE

Radiolodine Treatment during Pregnancy: Chromosomal Aberrations and Cretinism Associated with Maternal Iodine-131 Treatment. K. Goh; Monroe Community Hospital, Rochester, NY. *J Am Med Women's Assoc* 36:262, 1981

An 18-yr-old woman who had received 99 mCi of I-131 for the treatment of follicular carcinoma of the thyroid and who was subsequently found to be six weeks pregnant gave birth to an apparently physically normal male infant. Eight months later the infant was noted to have the appearance of a cretin, and functional thyroid activity was absent. Thyroid replacement therapy was instituted with improved physical development, but no improvement in speech development, mentation, or ability to walk or stand unassisted. Chromosomal studies of the mother and child were done when the child was 7 yr old. On two occasions, the child had 12% and 13% chromosomal breakages in two blood cultures taken peripherally, and in the mother's lymphocyte culture, 11% were found.

The Comparative Value of Serum Thyroglobulin Measurements and Iodine-131 Total Body Scans in the Follow-Up Study of Patients with Treated Differentiated Thyroid Cancer. M. W. Ashcraft, A. J. Vanherle; University of California, Los Angeles, CA. *Am J Med* 71:806–815, 1981

Thirty-two patients with well-differentiated follicular, papillary, or mixed papillary-follicular carcinomas of the thyroid were evaluated using a radioimmunoassay of serum thyroglobulin and I-131 total body scans. They had undergone total or nearly total thyroidectomy and in some cases I-131 ablative therapy. Patients with serum antithyroglobulin antibodies were excluded from the study. Serum thyroglobulin was assayed while the patients were receiving T_4 suppressive therapy, 28–42 days following its discontinuation, and 14–28 days after intervening T_3 therapy had been discontinued. Four to six weeks after T_4 was discontinued and 96 hr after the oral administration 5 mCi of I-131, a total body scan was obtained.

While on or off T_4 therapy, no metastases were detected in patients whose serum thyroglobulin level was undetectable (1.0 ng/ml). Detectable values during therapy, even as low as 4.2 ng/ml, were occasionally associated with metastases. No metastases were detected in patients off T_4 therapy when the serum thyroglobulin was less than 10 ng/ml. Above 10 ng/ml, metastases were often found in patients off T_4 therapy even when the scan was negative. The addition of thyroglobulin assays to a careful clinical evaluation and a total body scan were felt to improve the management of patients with previously treated well-differentiated thyroid carcinomas.

Diagnosis of Acute Hepatitis A by HAVAB^R-M, A Direct Radioimmunoassay for IgM Anti-HAV. R. H. Decker, S. M. Kosakowski, A. S. Vanderbilt, C. M. Ling, R. Chairez, L. R. Overby; Abbott Laboratories, North Chicago, IL. *Am J Clin Pathol* 76:140–147, 1981

The authors developed a solid-phase radioimmunoassay (RIA) for quantitating the IgM antibody to hepatitis A viral antigen (IgM anti-HAV). The RIA uses polystyrene beads coated with goat antiserum to human IgM (μ-chain specific). For RIA, 10 μl of patient serum or plasma is diluted and incubated with one bead for 2 hr. After washing, the bead is incubated with hepatitis A viral antigen (HAV), derived from livers of Tamarin marmosets in acute stages of hepatitis A, for 18–22 hr. After washing, I-125-anti-HAV is added to the bead and incubated for 4 hr. Finally, the bead is washed and assayed for radioactivity in a gamma counter. All the following sera specimens were negative in this RIA: from hepatitis B carriers and normal blood donors, patients with acute rubella, acute mononucleosis, acute hepatitis B, alcoholic hepatitis, rheumatoid factor, and IgG anti-HAV. IgM anti-HAV was detectable within a few days of onset of symptoms of hepatitis A and reached maximum concentrations within 1–3 wk. The methodology of this RIA represents a new generation of RIA and enzyme-immuno-assays capable of detecting both class and specificity of an antibody—IgM and anti-HAV activity.

Computer-Enhanced Thallium Scintigrams in Asymptomatic Men with Abnormal Exercise Tests. G. S. Uhl, T. N. Kay, J. R. Hickman; USAF Wilford Hall Med. Ctr, Lackland Air Force Base, Lackland, TX. *Am J Cardiol* 48:1037–1043, 1981

To evaluate the diagnostic accuracy of computer-enhanced thallium-201 (Tl-201) perfusion scintigraphy in asymptomatic men with abnormal exercise tests, multigated thallium scans were performed. Immediately after peak exercise and at 3 or 4 hr after exercise, multigated imaging sequences were collected at 15 msec/frame by means of a physiologic synchronizer interfaced with a digital computer system. The acquisition program measured the average R-R interval over 200 cycles. Two independent observers interpreted the unprocessed and processed images. A total of 191 patients were classified into three groups on the basis of results from coronary angiography: Group I—normal finding on coronary angiography (135 patients); Group II—minimal or subcritical coronary artery disease (15 patients); and Group III—significant coronary artery disease (41 patients). Use of computer enhancement resulted in only four false-positive scintigrams of 135 from Group I and two false-negative scintigrams of 41 from Group III. All 15 subcritical cases of coronary disease (Group II) had equivocal results on thallium scans, ten having abnormal scans, and five showing no defects. The clinical significance of such subcritical disease is unclear, but it can be detected with the thallium scan. The authors concluded that it is possible to detect coronary arterial stenosis by the use of computer-enhanced Tl-201 scintigraphy and it can be used effectively as a diagnostic tool in counseling patients about their likelihood of having coronary artery disease.

Localization of Coronary Artery Disease with Exercise Electrocardiography—Correlation with Thallium-201 Myocardial Perfusion Scanning. R. F. Dunn, B. Freedman, I. K. Bailey, R. F. Uren, D. T. Kelly; Royal Prince Alfred Hospital, Camperdown, Australia. *Am J Cardiol* 48:837–843, 1981

Sixty-one of 500 patients were selected who demonstrated single-vessel disease by coronary arteriography (70% or greater obstruction of luminal diameter in only one vessel) and no previous myocardial infarction. All 61 patients had 12 lead exercise ECGs and stress Tl-201 myocardial perfusion scanning; fifty patients (32 with LAD involvement, 18 with RCA/LCx) had reversible defects

on thallium scan. Ischemic exercise ECGs alone showed 43 cases (27 with LAD and 16 with RCA/LCx). A reversible anterior defect on exercise thallium scanning correlated with left anterior descending coronary artery disease and a reversible inferior thallium defect correlated with right coronary or left circumflex arterial disease. The site of exercise-induced S-T segment depression did not identify which coronary artery was obstructed. In the 37 patients with LAD disease S-T depression was most frequently seen in the inferior leads and leads V4 to V6. In the 18 patients with RCA disease and in the six patients with left circumflex arterial disease S-T depression was most often seen in leads V5 and V6. S-T segment elevation was uncommon in most leads but it occurred in lead V1 or a VL or both in 51% of the patients with LAD disease. Authors concluded that the site of S-T segment depression does not identify the obstructed coronary artery and that S-T segment elevation in V1 or a VL or both identifies LAD disease. The site of reversible perfusion defect on Tl-201 scanning identifies the site of myocardial ischemia and obstructed coronary artery.

An Assessment of Myocardial Function in Human Sepsis Utilizing ECG Gated Cardiac Scintigraphy. J. E. Calvin, A. A. Driedger, W. J. Sibbald; Victoria Hospital, London, Ontario, Canada. *Chest* 80: 579–586, 1981

The effect on myocardial function by systemic sepsis remains incompletely characterized. By using radionuclide angiography for the measurement of left ventricular ejection fraction (LVEF), left ventricular diastolic volume, velocity of ejection (dV/dT), the authors examined 20 patients with severe systemic sepsis who showed no evidence of shock. Twenty-one critically ill cardiac patients and 30 normal subjects were similarly examined for comparison. The 20 patients with sepsis and 21 cardiac patients had received invasive right heart catheterization to measure left ventricle heart work for subsequent Frank Starling relationships. The septic group had a higher mean stroke volume and left ventricular stroke work index at a lower pulmonary capillary wedge pressure, as well as higher systemic vascular and pulmonary vascular resistance index than the cardiac patients. The LVEF of septic patients, normal subjects, and cardiac patients was 54 ± 3%, 50 ± 2% and 26 ± 2%, respectively; LVEF for septic patients was significantly higher than for the cardiac population. The average dV/dT was greater in the septic group than in the normal group. The results of ventricular function curves for both cardiac and septic population showed significantly better function in the septic population at both intermediate (75–125 ml/m^2) and high (>125 ml/m^2) left ventricular end-diastolic volumes. Also noted was a good relationship between the ventricular stroke volume and systemic vascular resistance index (after load) in cardiac patients, although this was not observed in the septic group. Authors concluded that a depression in cardiac performance is not a major feature in early sepsis and that the hyperdynamic state of sepsis remains dependent upon an adequate preload.

Diagnosis of Coronary Artery Disease by Multigated Radionuclide Angiography during Right Atrial Pacing. D. Tzivoni, A. T. Weiss, J. Solomon, D. Warshow, M. S. Gotsman, H. Atlan; Hadassah University Hospital, Jerusalem, Israel. *Chest* 80:562–565, 1981

The authors had used right atrial pacing as a method to augment myocardial oxygen demand in conjunction with multigated radionuclide angiography (MRA) to evaluate left ventricular ejection fraction (EF) and wall motion. Seven normal subjects and 11 patients with angiographically documented coronary artery disease (CAD) were included in the study. The right atrium was paced at rates of 100, 120, 140, and 160/min, and continued for 3 min at each rate. Data acquisition and analysis were performed on a laboratory computer and wall motion was analyzed visually. More than a 15% reduction of EF was considered abnormal. In all seven normal subjects the EF (64 ± 8%) did not change during atrial pacing. In five of seven normal subjects the ECG during atrial pacing was normal and falsely pathologic in the other two. The atrial pacing produced positive ECGs in seven of 11 CAD patients and falsely negative in four. In MRA, nine of 11 CAD patients had more than a 15% reduction in EF, while only two were regarded as negative. A maximal decrease of 31% in the average EFs was observed in CAD patients at a pacing rate of 160/min. Wall-motion pattern remained normal in all seven normal subjects, whereas new abnormal wall motion developed during the pacing in nine of 11 CAD patients. Authors concluded that during pacing, changes in EF and wall motion are sensitive indicators for myocardial ischemia.

Doppler Flow and Radionuclide Scan Studies in the Evaluation and Management of Peripheral Artery Thrombosis in the Neonate. B. L. Pupala, R. Benawra, H. H. Mangurten, S. Naidu, P. Shirazi; Lutheran Gen. Hosp., Park Ridge, IL. *J Pediatr* 99:791–793, 1981

Two neonates who developed obstruction to the aterial blood supply in a lower extremity were initially evaluated and their subsequent clinical course followed by means of arterial Doppler flow studies and radionuclide angiography (RA). Both techniques substantiated the clinical impression of probable arterial occlusion and both provided the means for following the clinical course. The results of serial RA justified the following conclusions: (1) The final area of demarcation between normal tissue and gangrenous tissue was closely approximated by RA. (2) The initial clinical region of demarcation was much more proximal than that seen on the RA scan. (3) The clinical appearance of improvement in circulation lagged behind improvement in the RA study. (4) The final zone of demarcation of the gangrenous region was evident much earlier in the RA study than it was clinically. (5) Serial Doppler-flow studies and radionuclide perfusion studies allowed for a delay in surgical amputation and preservation of a greater amount of tissue in the extremity than would have occurred if only visual inspection of the affected area had been employed as a guide to the extent of tissue damage.

Radioruthenium—2, 3-Dimercaptopropansulfonic Acid Complex. A Potentially Useful Radiocompound for Kidney Studies. L. J. Anghileri, M. Ottaviani, S. Ricard, C. Raynaud; Orsay, France. *Eur J Nucl Med* 6:403–405, 1981

Radioruthenium-DMPSA was evaluated as a tracer for renal studies. The tracer was prepared by adding 4 *M* HCl to a 0.1–0.3 mCi per mg Ru-103 Cl carrier to make a solution containing 120 μg Ru-103 per ml. To this, 2 ml of DMPSA were added. The mixture was brought to pH 4.5. The preparation was heated for 20 min and was then passed through a Millipore filter. The same procedure was used to prepare Ru-97 DMPSA. Nine rabbits and 18 rats were studied to determine the in vivo distribution of the tracer. Maximum renal uptake was noted 7–10 hr after injection. Distribution calculated as percent dose per gram wet tissue was influenced by pH. In rats renal uptake of Ru-103 DMPSA at 24 hr was 19.6 ± 1.4% at pH 7.2 and 26.9 ± 3.4% at pH 4.5. The authors conclude that the physical properties Ru-97 and the good renal uptake of the ruthenium-labeled DMPSA combine to make the radiopharmaceutical a potentially useful tracer for functional studies and for imaging.

Cleansing the Colon in Gallium-67 Scintigraphy—A Prospective Comparison of Regimens. G. J. Novetsky, D. A. Turner, A. Ali, W. J. Raynor, Jr., E. W. Fordham; Rush Presbyterian Medical Ctr., St. Luke's, Chicago, IL. *Am J Roentgenol* 137:979–982, 1981

Various regimens for cleansing the bowel in preparation for gallium-67 citrate (Ga-67) scans were prospectively evaluated over a 7-mo period in 309 patients (excluding those unable to tolerate purgatives or those suffering from inflammatory bowel disease). Before Ga-67 scanning each patient was randomly assigned to one of four cleansing protocols: (a) high-fiber diet (11.2 g) with 6-8 cups of fluid daily for 3 days; (b) 30 ml castor oil each night for two consecutive nights; (c) 30 ml milk of magnesia with 5 ml cascara sagrada each night for three consecutive nights; (d) no preparation.

Seventy-two hours after the i.v. administration of 3-10 mCi Ga-67 citrate, Ga-67 scans were obtained using a gamma camera. The scans were evaluated for colonic activity on a scale of 0-3 by three independent observers.

High rates of noncompliance with the assigned regimen were found: 83% for protocol (a), 68% for protocol (b), 64% for protocol (c), and 54% for protocol (d). Only protocol (b) (castor oil) demonstrated a significant difference ($p = 0.047$) over no preparation. The failure of patients to follow instructions may account for many of the differences reported in the literature for the efficacy of various bowel preparation regimens used in Ga-67 scanning.

Serodiagnosis of Tuberculosis by Radioimmunoassay. W. D. Winters, R. A. Cox; San Antonio State Chest Hosp., San Antonio, TX. *Am Rev Respir Dis* 124:582–585, 1981

Since the current diagnosis of tuberculosis is still mainly dependent upon bacteriologic cultures (which are slow and complicated) and tuberculin skin tests (with false-positive reactions), the authors attempted to develop a rapid diagnostic assay that measured serum IgG antibodies reaction against *M. tuberculosis* and *M. bovis* (BCG) antigen in the sera of tuberculous patients. Four categories of patients were studied: Group I—patients with active tuberculosis, 54; Group II—patients with inactive tuberculosis, 6; Group III—healthy subjects with positive PPD skin test, 15; Group IV—healthy subjects with negative PPD skin test. On the basis of a solid phase, bead-type radioimmunoassay, Group I patients had statistically larger amounts of IgG antibody to *M. tuberculosis* whole cells, cell walls, and PPD and to BCG whole cells and cell walls when compared with the amount of antibody in sera from Group IV subjects (PPD skin test negative). No significant differences, however, were detected in the mean antibody response or frequency of positive antibody responses between patients with active disease and those in clinical remission. Significant amounts of antibody were detected in 7-12% of Group IV patients. On the basis of these results, the authors concluded that antibody assay alone will unlikely prove useful in the diagnosis of the tuberculosis.

Methods for Evaluation of Diagnostic Imaging Instrumentation. D. Shosa, L. Kaufman; University of California at San Francisco, San Francisco, CA. *Phys Med Biol* 26:101–112, 1981

The authors develop a formulation, based on the Rose model of signal-to-noise ratio in images, that permits extraction of effective spatial resolution and sensitivity parameters by use of low contrast features. The model takes into account the lesion contrast, the effect of the point-spread function, and texture. The model suggests nuclear medicine images are often as "texture" limited as statistics limited, and thus increasing the count density will not yield commensurate increases in diagnostic efficacy. The model, which considers only signal-to-noise levels, does not fully describe the entire imaging system; however, it can be extended to other imaging modalities.

Time Differential Perturbed Angular Correlation (TDPAC) Studies on the ^{133}Ba Ion Uptake in Bone Crystals. J. N. Rimbert, C. Kellershohn, F. Duma; Hubert C. Faculté de Medecine Necker—Enfants Malades, Paris, France. *Phys Med Biol* 26:221–230, 1981

Using the two gamma rays emitted in cascade (356-81 keV) from the electron capture decay of Ba-133, time-differential, perturbed angular correlation (PAC) studies were made of $BaCl_2$ in aqueous solution, as polycrystalline powder, and bound to bone powder. The results imply that bone powder has initially two Ba-133 uptake sites and seem to confirm that some of the Ba^{2+} ions can penetrate into the apatite crystals and exchange with the Ca^{2+} ions, the diffusing fraction dependent upon the contact time. The authors concluded the PAC technique is a convenient and powerful means for studying the uptake of alkaline and rare earths in bone.

The Usefulness of Indices Measuring Gamma Camera Non-Uniformity. P. Sharp, T. Marshall; University of Aberdeen, Aberdeen, Scotland. *Phys Med Biol* 26:149–153, 1981

Four measures of uniformity were evaluated by a ranking technique to determine how well the subjective impression of uniformity agreed with the values provided by each of the objective measures. The uniformity measures used were: (1) mean integral nonuniformity, (2) differential nonuniformity, (3) coefficient of variation of the counts per element, and (4) a measure of the width of the frequency distribution of the contrast between neighboring elements. Similar results were found for black and white and color images and the authors found that a 20% change in the uniformity measure is needed to produce a visually perceptible difference. Furthermore, the mean correlation coefficient for measure (4) was the highest whereas measure (1) had the lowest correlation.

Microprocessor Crosstalk Correction in Multiple-Detector Gamma Counters. T. G. R. Rawlins, T. Yrjonent, N. Veall; Clinical Research Center, Harrow, England. *Phys Biol Med* 26:425–434, 1981

In an effort to reduce the energy-dependent error due to crosstalk between individual detectors in multiple-detector gamma counters, the authors devised and tested a microprocessor-controlled correction scheme. The procedure requires standardization of the detectors with a source of radioactivity having similar geometric and gamma ray energy characteristics to the samples being counted. Copies of the patent-protected program algorithm and program listing are available from the authors.

The Influence of Penetrating Radiation on Collimator Performance. M. F. Johns; The University of Texas System Cancer Center, M. D. Anderson Hospital, Houston, TX. *Phys Med Biol* 26:113–124, 1981

A computer model to estimate the geometric and penetration response of a multihole focused collimator to a point source was developed by using ray-tracing techniques. The collimator response to a line source was similarly calculated, from which the modulation transfer function was derived. The authors concluded that the calculated geometric edge penetration and system penetration responses agree well with experimentally determined values, so that the model should be useful for evaluating existing or proposed collimator designs.

Sonography of Hypertensive Portal Venous System: Correlation with Arterial Portography. J. L. Dach, M. C. Hill, J. C. Pelaez, J. R. LePage, E. Russell; University of Miami School of Medicine, Miami, FL. *Am J Roentgenol* 137:511–517, 1981

In a study of 16 patients with portal hypertension, sonography was useful in demonstrating both collateral and abnormally dilated portal venous branches. Dilated umbilical veins, periportal collaterals, dilatation of the left gastric vein, and the presence of perigastric veins indicating gastroesophageal varices were identified sonographically and correlated with arterial portography studies. Dilatation of normal venous structures, such as the inferior mesenteric vein, coronary vein, and splenic vein, was identified as well. Limitations include the inability of sonography to provide blood-flow direction information. Sonography proved a useful adjunct to arterial portography, however, since it demonstrated vessels not opacified by virtue of hepatofugal flow. The sonograms and correlating portograms are presented.

Ultrasonic Evaluation of the Postpartum Uterus in the Management of Postpartum Bleeding. C. Y. Lee, B. Madrazo, B. H. Drukker; Henry Ford Hospital, Detroit, MI. *Obstet Gynecol* 58:227–232, 1981

In a study of 56 patients with postpartum bleeding, the authors found retained placental tissue in nine and blood clots in five. The normal empty postpartum uterus was clearly identified by demonstration of the linear endometrial echo, the thickness of which varied from 0.5 to 1.3 cm. Retained placenta appeared as an echogenic mass with occasional shadowing produced by calcifications. Retained blood clots produced a less echogenic and more complex pattern. On the basis of negative ultrasound examinations, 42 patients treated with intravenous oxytocin infusion showed good results. A high degree of accuracy was attained in the ultrasonographic differentation of retained placental tissue and blood clots in an empty uterus.

Renal Parenchymal Disease: Histopathologic-Sonographic Correlation. A. T. Rosenfield, N. J. Siegel; Yale University, New Haven, CT. *Am J Roentgenol* 137:793–798, 1981

In 25 consecutive patients who underwent percutaneous renal biopsy, the authors studied the echogenicity of renal cortex, closely following the ultrasound examination. Normally, increasing echogenicity is seen from renal cortex, to spleen, to liver, and to renal sinus. When renal cortical echogenicity exceeds that of spleen or liver, parenchymal disease is suspected. No correlation was found between the nature and/or severity of glomerular disease on renal biopsy and echogenicity of the renal cortex. Definition of the corticomedullary junction also showed no correlation. A direct correlation was identified between the nature and severity of interstitial changes on biopsy and the intensity of cortical echogenicity. Focal interstitial changes were found to produce a slight increase in cortical echogenicity, diffuse scarring produced a greater increase, and active interstitial infiltrate produced the highest level of echoes. Representative sonograms and photomicrographs of the histologic specimens are provided.

Echogenicity: Analysis, Significance, and Masking. A. B. Kurtz, P. A. Dubbins, C. S. Rubin, R. I. Kurtz, H. S. Cooper, C. Cole-Beuglet, B. B. Goldberg; Thomas Jefferson University Hospital, Philadelphia, PA. *Am J Roentgenol* 137:471–476, 1981

Based on in vivo and in vitro experiments, evidence indicated that echogenicity cannot be ascribed to a specific tissue but is, instead, a property of all substances. Combinations of mineral oil and water, when separated, are both seen to be echo-free with a strong specular echo at the interface between the two liquids. When agitated together, homogeneous echogenicity results throughout. The same procedure repeated with the exclusion of air produces similar results, indicating that the widespread echogenicity throughout is not secondary to microbubbles. In vivo studies demonstrated that echogenicities of various tissues could be quite similar regardless of histologic or pathologic composition. Two tissues of equal echogenicity in apposition will produce the "masking sign," analogous to the silhouette sign of like densities on a radiograph. The authors conclude that echogenicity depends only on tissue inhomogeneity regardless of histologic and pathologic makeup. Representative sonograms of in vivo and in vitro studies are shown.

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