

ABSTRACTS OF CURRENT LITERATURE

Radioactive Phosphorus-Uptake-Testing Variables Before and After Enucleation. B. G. Goldstein, D. M. Robertson; Mayo Clinic, Rochester, MN. *Arch Ophthalmol* 99:435-436, 1981

The percentage of uptake of P-32 before and immediately following enucleation was determined in 23 eyes with choroidal malignant melanoma and found to be greater following enucleation in 21 eyes. In 11 of the 23 eyes, the increase was greater than 100%. Aside from previously reported causes for uptake variability, the influence of probe pressure on percent uptake of P-32 is advanced as yet another cause. In the enucleated eye, a decreased choroidal blood volume causes less central counts, closer approximation of the probe to the tumor, greater tumor counts, and, therefore, a greater percent of P-32 uptake at the tumor site. Before enucleation, minimal pressure is applied on the tissue by the probe, thereby allowing a greater choroidal blood pool and greater control counts. The authors conclude that wide variation in observed P-32 uptake could result from variation in pressure on the probe. Because there are "compelling reasons to handle tissue gently and to minimize pressure on the eye, particularly when it is suspected of harboring a malignant neoplasm," they have not tried to document this clinically.

Prediction of Lymph Node Metastases by Lymphoscintigraphy of the Neck after Peri-Cancer Injection of a Radiocolloid. G. J. Parell, G. D. Becker, G. T. Simpson; Veterans Administration Wadsworth Center, Los Angeles, CA. *Otolaryngol Head Neck Surg* 89:67-69, 1981

Six patients with oral squamous cell carcinoma were studied preoperatively to determine whether lymphoscintigraphy could predict metastases to cervical lymph nodes. In a volume of 0.5 cc, 2 μ of technetium 99-m labeled sulfur colloid were injected adjacent to the tumor and two days later an injection at a similar site was made on the opposite side to serve as a control. Lateral, oblique, and anterior images were obtained at 20 min, 4, 8, and 14 to 16 hr following each injection. If no difference in the intensity of the images of both sides was observed, they were considered normal, whereas a decrease in image intensity or absence of uptake was considered to be indicative of metastases. Neck dissection was subsequently done. Two patients with histologically positive lymph nodes had absent cervical node activity upon imaging. Three patients with no metastatic lesion in lymph nodes had normal (activity present) images. One patient in whom it was felt the injection was made into the tumor and who had histologically negative lymph nodes had no node activity on the scintigram.

Bleomycin Labeled with ^{99m}Tc for Differentiation of Breast Tumors. D. Warczyglowa, S. Szostak, Z. Marzecki; St. Tustanowski, Szczecin, Poland. *Eur J Nucl Med* 6:59-61, 1981

The authors evaluated Tc-99m bleomycin to differentiate benign and malignant breast tumors. Thirty-two patients with unilateral breast tumors were studied before treatment. 1-2 mg bleomycin were labeled with 5 mCi pertechnetate. The labeled bleomycin did not contain free pertechnetate or Tc-Sn colloid complex. Breast scintigraphy followed 15 and 60 min after i.v. injection of Tc-99m bleomycin. Ten patients were examined with a rectilinear scanner and 22 patients with a gamma camera equipped with minicomputer, and diagnoses were verified histologically. 14 of 32 patients

had a malignant disease and 18 had benign lesions. Images obtained at 15 and 60 min were comparable. All patients with malignant tumors had increased accumulation of labeled bleomycin in the tumor. Benign tumors failed to demonstrate abnormal uptake. Quantitative scintigraphy revealed that radiotracer uptake in malignant tissue was 2.8-5 times that found in normal breast tissue.

Gallium-67 Scanning To Stage the Alveolitis of Sarcoidosis: Correlation with Clinical Studies, Pulmonary Function Studies, and Bronchoalveolar Lavage. B. R. Line, G. W. Hunninghake, B. A. Keogh, A. E. Jones, G. S. Johnston, R. G. Crystal; NHLBI, Bethesda, MD. *Am Rev Resp Dis* 123:440-447, 1981

The presence of large numbers of T-lymphocytes in the lower respiratory tract in patients with pulmonary sarcoidosis is currently considered to be the most reliable indicator of activity of the disease process. Scanning with gallium-67 citrate offers a means of non-invasively assessing the alveolitis in these patients and aids in their staging and management. In this study, 41 patients (14 men, 27 women, mean age 35.7 \pm 1.8 yr) with sarcoidosis were studied by roentgenographic, hematologic, biochemical, pulmonary functional, and scintigraphic methods. A control population consisted of 19 subjects. The degree of gallium-67 uptake in the lungs was determined from posterior scans of the thorax taken 48 to 72 hr after i.v. injection of 50 μ Ci/kg gallium-67 citrate. Semiquantitation of the uptake was obtained by computation of a "Ga-67 index," with normal values being 50 or less. All control subjects had Ga-67 index values in the normal range while 61% of the sarcoidosis patients demonstrated significant pulmonary parenchymal uptake with Ga-67 index values >50. Bronchoalveolar lavage studies on 34 of the 41 patients revealed increased numbers of lymphocytes; T-lymphocytes were elevated in 22 of 24 patients where these were quantitated. The Ga-67 index showed highly significant correlation with both the percentage of cells that were lymphocytes ($p = 0.0001$, $r = 0.67$) and the percentage of cells that were T-lymphocytes ($p = 0.0001$, $r = 0.71$).

Exercise-Induced Regional Wall Motion Abnormalities On Radionuclide Angiography. H. S. Hecht, J. M. Hopkins; Wadsworth Veterans Administration Medical Ctr., Los Angeles, CA. *Am J Cardiol* 47:861-865, 1981

Twelve patients without evidence of coronary artery disease (Group I), 35 patients without valvular heart disease but with angiographically demonstrated 50% or greater occlusion of one or more coronary arteries (Group II), and 19 patients without coronary artery disease but with valvular heart disease (Group III), underwent rest and stress radionuclide angiography. Gated data were acquired following in vivo red blood cell labeling. From these data, left-ventricular ejection fractions were calculated and wall motion analysis of three regions of the left-ventricular wall, as seen in the left anterior oblique view, was undertaken.

In Group I patients, a normal increase in ejection fraction (an increase of 5% or more) occurred with exercise, and regional wall motion abnormalities did not develop. In Group II patients, 77% had an abnormal ejection fraction response to exercise, and 63% developed regional wall motion abnormalities. 83% had one change or the other and in 20% both abnormalities developed. In Group

III patients, 42% developed regional wall motion abnormalities (7 of the 8 of which were inferoapical) and 32% developed global abnormalities. All patients with exercise-induced regional wall motion abnormalities had an abnormal ejection fraction response as did all but one of the patients who developed a global abnormality. In the presence of valvular heart disease, exercise-induced regional wall motion abnormalities are not reliable indicators of coronary artery disease.

Right Ventricular Infarction—Relationships between ST Segment Elevation in V₄R and Hemodynamic, Scintigraphic and Echocardiographic Findings in Patients with Acute Inferior Myocardial Infarction. J. Candelliera, J. Figueras, V. Valle, A. Alvarez, L. Gutierrez, J. Cortadellas, J. Cinca, A. Salas, J. Rius; Unidad Coronaria, Paseo Valle Hebron S-N, Barcelona, Spain. *Am Heart J* 101: 281–288, 1981

The diagnosis of right ventricular infarction (RVI) has been difficult in clinical practice. This study of 42 patients (36 males, 6 females) with acute inferior transmural myocardial infarction (AMI) was done to correlate the electrocardiographic (ECG), hemodynamic, echographic, and scintigraphic findings indicative of acute right ventricular necrosis. Six of the patients also had anteroseptal AMI and one had, in addition, extensive anterior AMI. All were studied within 24 hr of the onset of AMI using serial 12-lead ECG with added V₄R, serum enzymes, and right heart catheterization. Technetium-99m pyrophosphate (PYP) myocardial scintigrams were obtained 1–5 days after the onset. In seven patients the ECG, echographic, hemodynamic, and scintigraphic studies were positive for RV involvement, whereas in ten patients these were negative. Of the remaining patients, ten had positive hemodynamic and scintigraphic findings ($p < 0.01$), nine had positive hemodynamic and echographic findings ($p < 0.02$), and ten had positive scintigraphic and echographic findings ($p < 0.02$). Postmortem examination of two patients showed right ventricular myocardial necrosis. It was concluded that all patients with inferior AMI should have lead V₄R included on ECG. If right ventricular involvement is indicated, scintigraphic and echocardiographic findings can support the diagnosis. Hemodynamic evaluation is of value in assessment and management.

Kr-81m for Determination of Right Ventricular Ejection Fraction (RVEF). W. H. Knapp, F. Helus, R. M. Lambrecht, R. Elfner, H. Gasper, H.-H. Vollhaber; Heidelberg, Germany. *Eur J Nucl Med* 5: 487–492, 1980

The authors evaluated Kr-81m for right ventricular ejection fraction (RVEF) determination in 25 patients. Six of these had no known cardiac disease. Three had evidence of pulmonary artery hypertension (right heart catheterization), and four had impaired myocardial function (left ventriculography). Twelve patients had ECG abnormality or cardiomegaly. Kr-81m was produced by a ⁸¹Rb → ⁸¹Kr generator. During the study the radionuclide was delivered in glucose solution at the rate of 60 ml per min by i.v. infusion. A gamma camera on line with a minicomputer and equipped with a low-energy, all-purpose collimator was used. Images were obtained in anterior projection, and data acquisition began with tracer passage through the superior vena cava. Data were gathered for 13 sec at 12 frames/sec. The infusion was terminated at the end of data acquisition. The procedure was done four times in each patient, so the total accumulation time for each study was 52 sec. For data evaluation the right ventricle was flagged. End-diastole and end-systole were identified for the heart cycles, and the RVEF was calculated. In eight patients the investigation was repeated after a time interval of 15 min, to test the reproducibility of the procedure. The authors found that an av-

erage of 30 end-diastolic right ventricular images existed for each evaluation. The patients without evidence of heart disease had RVEF values between 48–52%. Patients with ECG abnormalities or cardiomegaly had values between 13–46%. Patients with verified pulmonary hypertension or myocardial disease had RVEF values between 13–38%. Repeat studies done in eight patients to test reproducibility resulted in values very similar to those obtained in the first examination. The authors conclude that Kr-81m is suitable for determination of RVEF.

Intravenous Xenon-133 for the Determination of Radionuclide First Pass Right Ventricular Ejection Fraction. M. Goldberg, J. Mantel, M. Friedlin, R. Ruskin, M. Rubenfire; Sinai Hospital of Detroit and Wayne State Univ., Detroit, MI. *Am J Cardiol* 47:626–630, 1981

First-pass right ventricular radionuclide ejection fractions were measured in 13 patients using intravenously administered Xe-133. Ten of the 13 patients had clinically significant heart disease and three were normal volunteers. 15–20 mCi of Xe-133 dissolved in saline were injected into a large autecubital vein via a Teflon catheter as a bolus followed by a saline flush. In one patient the bolus was introduced directly into the right atrium via a Swan-Ganz catheter. Imaging was obtained using a single crystal Anger gamma scintillation camera equipped with a general purpose or high sensitivity low energy parallel hole collimator directed in the 30° right anterior oblique projection. Data were collected in list mode or frame mode by a digital computer. A photopeak setting of 80 keV using a 20% window was selected. A region of interest representing only the right ventricle was selected, corrected for background activity, and time-activity curves were generated. The difference in the number of counts at end-diastole and end-systole was divided by the number of counts in end-diastole to obtain the right ventricular ejection fraction. The counts from two or three cardiac cycles were averaged. For purposes of comparison each study was repeated in similar fashion utilizing Tc-99m labeled human serum albumin. Fifteen determinations were made by each method and when compared, the correlation coefficient was $r = 0.98$ ($p = 0.002$).

The advantages of Xe-133 right ventricular ejection fraction determinations rest in the fact that the tracer is rapidly eliminated by the lungs, allowing for serial determinations in a short time span and a reduction in radiation exposure to the patient.

These features may make this technique well-suited for applications in critical care medicine such as in the evaluation of pre- and post-treatment right ventricular function in patients with predominantly right ventricular myocardial infarction and cardiogenic shock. Its main disadvantage at the present time rests in its cost.

The Arterial Contribution to Total Liver Perfusion. H. Creutzig, O. Schober, Ch. Brölsch, R. Pichlmayer, H. Hundeshagen; Hannover, Germany. *Nucl Med (Stuttg)* 20:25–29, 1981

The determination of arterial perfusion of the liver may be valuable before portosystemic shunt surgery. The authors compared five techniques used to calculate the arterial contribution to hepatic perfusion. They examined 30 patients with cirrhosis and 16 patients with verified, pure arterial perfusion. Eighteen persons served as controls. Gamma camera scintigraphy of the upper abdomen followed injection of 10 mCi of Tc-99m. Data were collected for 1 min at 0.5-sec intervals. Flow curves were generated over the aorta, liver, right or left kidney, spleen, and right lung. Data obtained in patients with cirrhosis and in controls were evaluated according to the method of Biersack and with a modification of it. Each study was evaluated five times to determine reproducibility. Patients with pure arterial perfusion of the liver

were evaluated also according to procedures described by Boyd, Fajmann, and George. The authors identified three basic flow curves in patients with pure arterial perfusion. Arterial perfusion, calculated according to the different methods, ranged from 76–123% of total hepatic blood flow. The method described by George resulted in the lowest and the procedure of Boyd in the highest values. The method of Fajmann and the modification of the procedure described by Biersack resulted in similar values. Both correctly estimated arterial perfusion at 100%. Repeat evaluations of the same examination resulted in a mean deviation of 1 in normals and 23% in cirrhosis. The authors conclude that dynamic hepatic scintigraphy should not be used when minor alterations in the ratio of portal and arterial hepatic perfusion are to be identified, since slight changes cannot be recognized with the pertechnetate bolus technique.

Scintigraphic Assessment of Biliary Reflux into the Residual Stomach After Subtotal Gastrectomy and Gastrojejunostomy. S. Gustavsson, L. K. Enander, B. Jung, M. Krog; Uppsala, Sweden. *Acta Radiol Diagn* 21:639–643, 1980

The authors examined 18 patients for biliary reflux into the gastric remnant after subtotal gastrectomy. For stomach visualization patients were given 50 μ Ci (2 MBq) Tc-99m tin colloid orally in 25 ml fluid. The gastric remnant and the small bowel were flagged. Following i.v. injection of 2 mCi (75 MBq) Tc-99m HIDA gamma camera images were made every fifth minute for 1 hr. The counts collected each minute in each ROI were registered. After 30 min patients were given a fatty meal. The authors observed HIDA in the biliary ducts and gallbladder within 10 min. At 15 min it was seen in the afferent loop of the small bowel. Biliary reflux was identified when the count rate over the gastric remnant increased significantly. Biliary flow increased following the fatty meal. In six patients reflux was not demonstrated. Nine patients had reflux only after bile flow provocation with the fatty meal. Spontaneous biliary reflux was identified in three patients. The fatty meal resulted in increased activity in the stomach of these patients. Repeat studies were not done to determine reproducibility of the results. The authors conclude that the scintigraphic technique offers the promise of a simple, specific, and noninvasive test for the assessment of biliary reflux.

The Renal Quantitative Scintillation Camera Study for Determination of Renal Function after Anatomic Nephrolithotomy. R. Thomas, R. W. Lewis, J. A. Roberts; Tulane Univ., New Orleans, LA. *Urology* 125:287–288, 1981

Quantitative scintigraphic studies to evaluate renal function, individual and total, were done pre- and posthypothermic anatomic nephrolithotomy in 35 patients with staghorn calculi. The calculus was unilateral in each instance, thereby permitting use of the nonoperated kidney as a normal control. Effective renal plasma flow (ERPF) was determined by scintigraphy using I-131 hippuran. BUN and creatinine levels were determined before surgery and at an average interval of 13.6 mo postoperatively. After surgery, total ERPF showed an insignificant decrease; however, ERPF on the operated kidney decreased from 258 to 182 ml/min/1.73 M² (p 0.01) and increased in the control kidney from 321 to 367 ml/min/1.73 M². No statistically significant difference was found between the pre- and postoperative BUN and creatinine values. These findings indicate that while total renal function is unchanged by the operative procedure, the operated kidney does have a significant loss of function with proportionate compensatory hypertrophy of the contralateral kidney. Despite some loss of renal function due to operation, progressive loss is prevented by hypothermic anatomic nephrolithotomy, indicating that this is a good

operative approach for management of patients with staghorn calculus.

Bone Marrow Uptake of ^{99m}Tc-Sulfur Colloid after Severe Abdominal Trauma in Children. F. W. Smith, R. G. Brown, D. L. Gilday, J. M. Ash; Hospital for Sick Children, Toronto, Canada. *Pediatr Radiol* 10:169–171, 1981

The authors report that liver-spleen scans obtained after blunt abdominal trauma can demonstrate increased uptake of Tc-99m sulfur colloid (TSC) by the bone marrow. The authors scanned 61 children after blunt abdominal trauma, and scintigraphy revealed increased bone marrow uptake in four of the patients. The authors believe that a disturbance of intrahepatic and/or intrasplenic blood flow results in flow redistribution away from the abdominal organs, and results in increased uptake by the skeleton.

Radioimmunoassay of Serum Myoglobin in Neuromuscular Disease. H. Askmark, P. O. Osterman, L. E. Roxin, P. Venge; Ybuv Hospital, Uppsala, Sweden. *J Neurol Neurosurg Psychiatry* 44: 68–72, 1981

Clinical employment of authors' solid-phase radioimmunoassay for quantity serum myoglobin (Mb), a protein indicator of skeletal and myocardial muscle damage, is described. Serum Mb level in 99 normal adults is 35.7 \pm 20.8 μ g/l (mean \pm 2 s.d.) in women and 50.6 \pm 39.6 μ g/l in men. Eighty-five patients (44 male) aged 20–80 yr having muscular symptoms and diagnoses documented by established procedures were studied. Of the 28 patients having myogenic myopathy, 26 (93%) had elevated Mb levels for the greatest incidence. In that group, all 11 patients with polymyositis had the highest variation of Mb: 94–1972 μ g/l (mean 701).

Of the eight patients having muscular dystrophy and the nine having unclassified myogenic myopathy, Mb was elevated in seven and eight, respectively. Serum creatine kinase (CK) was elevated in only 55–64% of those patients. In 28 patients with disturbed neuromuscular transmission (myasthenia gravis) and in 12 with neurogenic muscular atrophy, Mb was elevated in roughly half. However, Mb was increased in only two of 16 patients having muscular ache but no evidence of neuromuscular disease. Elevated CK existed in 0–24% of the latter groups. Seven patients being treated periodically for polymyositis were followed over the 6–33 mo period, revealing a clear relationship among Mb, CK levels and clinical course in six of them. The authors find the serum Mb to be generally a more sensitive indicator of muscle disease than is CK.

An Approach to Fungal Antigen Relationships by Radioallergosorbent Test Inhibition. R. M. Karr, M. R. Wilson, V. R. Anicetti, S. B. Lehee, R. T. Butcher, J. E. Salvaggio; Tulane Univ., New Orleans, LA. *J Allergy Clin Immunol* 67:194–198, 1981

Aspergillus species causes several clinical pulmonary disorders characterized by unique immunologic features. Of those diseases, allergic bronchopulmonary aspergillosis and allergic asthma occur mainly in atopic persons and involve type I IgE mediated hypersensitivity. A radioallergosorbent test (RAST) index of mean 6–8.1 was obtained with fungal antigens from *Aspergillus fumigatus*, *A. glaucus*, *A. flavus*, and *Alternaria tenuis* tested individually. A cross-RAST inhibition study on equal weights of each of the three possible pairs of *Aspergillus* species (in which each member of a pair was used as the test antigen for inhibition of RAST to the other member of the pair) revealed significant but only partial inhibition of RAST-detecting IgE antibodies to the other two species. *Alternaria tenuis* was found to be antigenically unrelated

to the *Aspergillus* species. The paired cross-RAST inhibition technique permits comparison of antigenic relationships among poorly characterized crude preparations of antigenic fungal substances implicated in human allergic (IgE-mediated) disease.

Resolution of Pinhole Collimators Used with Gamma Cameras. P. Goulet, M. L. G. Joy; University of Toronto, Toronto, Canada. *Med Phys* 7:571-573, 1980

In coded-aperture systems and other systems utilizing pinhole collimators, it is often of interest to know the full width at half maximum (FWHM) of the line-spread function (LSF). Experimentally measured values are often significantly different from the numbers obtained using the equation for the resolution index presented by Anger. An empirical equation based on camera and pinhole collimator parameters is proposed so that a FWHM can be calculated that is in good agreement with experimentally measured values. The equation is valid for low-energy photon sources such as Tc-99m and I-123 but may not hold for higher-energy photons such as those emitted by I-131. An accuracy of $\pm 3\%$ is claimed in predicting the FWHM of the LSF under a wide range of conditions.

Coincidence Sum Peak Assay of I-125 Activity Using Solid-State Detectors. C. C. Ling, P. J. Biggs; Massachusetts General Hospital, Boston, MA. *Med Phys* 7:551-554, 1980

To determine the thyroid burden in research workers exposed to I-125, it is necessary to calibrate uptake systems accurately. By using the method of coincidence sum peaks, the absolute activity of I-125 can be assayed without knowing the detector efficiency and without correcting for sample self-absorption. Although NaI detector systems can be used for this purpose, the improved energy resolution of solid-state detectors (Si(Li) and intrinsic germanium) provides improved signal-to-background ratios and yields mathematical formulae that overdetermine the radioactivity in a sample. Overdetermination of the sample activity provides a consistency check for the calibration procedure. A number of different sources of I-125 with activities ranging from 0.01 to 0.5 μCi were assayed. Depending on the source activity, the estimated error was 2 to 3%.

Ultrasonic Characteristics of Bilomas. H. G. Zegel, A. B. Kurtz, G. S. Perlmutter, B. B. Goldberg; Thomas Jefferson University Hospital, Philadelphia, PA. *J Clin Ultrasound* 9:21-24, 1981

Five patients in whom bilomas were surgically proven demonstrated characteristics felt to be relatively common in this entity. Echo-free collections with good sound transmission were seen; sharp margination, loculation, and contiguity with the liver or biliary structures were noted as well. All the collections in the current study were found to be relatively large, with the smallest measuring $3 \times 2 \times 7$ cm. By virtue of the intense inflammatory response generated by the bile, a walled-off configuration ensues rapidly, and the resultant biloma presents as a combination of space-occupying and space-conforming fluid. The history of surgical manipulation is helpful; however, this entity can occur spontaneously.

Ultrasonic Prediction of Complications Following Normal Vaginal Delivery. J. K. Lipinski, A. H. Adam; Queen Mother's Hospital, Glasgow, Scotland. *J Clin Ultrasound* 9:17-19, 1981

In a study of 100 uncomplicated pregnancies the authors categorized the postpartum appearance of the uterus into three groups. The empty uterus contained a clear midline echo and no intra-uterine tissue, indicative of a benign postpartum course. Separation of the walls of the endometrial cavity produced by sonolucent regions represents retained blood and clot. This condition is relatively common but resolves within the first three days after delivery. Retained tissue after the fourth day is considered an indication for surgical evacuation of the uterus. The third pattern involves dense echoes within the uterine cavity and indicates retained products of conception. If this latter finding has not resolved by the fourth day, consideration is given to surgical evacuation of the uterus.

Bulging Amnion in Premature Labor: Spectrum of Ultrasonographic Findings. A. M. Fried; University of Kentucky Medical Center, Lexington, KY. *Am J Roentgenol* 136:181-185, 1981

Premature labor or vaginal bleeding in the second and third trimesters may be associated with a spectrum of sonographically definable abnormalities of the endocervical canal. Of 13 patients encountered, eight demonstrated dilatation of the entire canal, which contained fluid, placenta, and small parts in various combinations—all delivered prematurely. The other five, in whom dilatation was limited to the proximal canal, carried to term. Seven fetuses were breech and six transverse. None were cephalic. Abnormalities of the cervical canal were seen in 6.9% of patients examined over a one-year period for bleeding in the second and third trimesters.

Transverse Common Duct. J. B. Jacobson, P. A. Brodey; University of California Medical Center, San Francisco, CA. *Am J Roentgenol* 136:91-95, 1981

In a review of 118 intraoperative cholangiograms the authors found a transverse segment of the extrahepatic bile duct in approximately 6% of normal patients. In the presence of obstruction of the common duct, the percentage rose to approximately 18%. Since the expected course of the common duct is oblique or nearly vertical, the horizontal portion in such instances may be confused with branches of the portal and splenic veins on sonography. The authors cautioned that tracing of such a ductal structure to its origins may be necessary for clarification. Sonograms and cholangiograms are provided.

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