

## ABSTRACTS OF CURRENT LITERATURE

**The Clinical Significance of Serum  $\alpha$ -1-Fetoprotein (AFP) Determination.** W. Weiss. *Onkologie* 1: 6-15, 1978.

The author reviews Alpha-1-Fetoprotein (AFP) literature and presents the results of a study in which 4,000 persons were screened for primary hepatic tumors (PHT). One hundred and eight PHT were identified. Ninety-three of these patients died, 80 of whom had autopsy. The author hoped to develop an AFP screening test sensitive enough to be useful, but insensitive enough not to result in excessive numbers of false-positive findings. The author therefore used a method with an AFP sensitivity of 100 ng/ml. Seventy of the 80 patients with PHT had liver scintigraphy with Tc-99m sulphur colloid, and 65 had a Ga-67 citrate liver scintigram. The effectiveness with which PHT was identified with the AFP test and with the nuclear medicine procedures was then compared. It was found that 78% of the PHT were identified with the AFP screening test, 80% of the tumors were visualized with gallium citrate studies, and 92% of the hepatic lesions were seen with Tc-99m sulphur colloid scintigraphy. The combination of AFP screening and Ga-67 citrate liver scintigraphy resulted in the identification of 94% of all PHT. The author concludes that combining an AFP screening test, having a sensitivity of 100 ng/ml, and Ga-67 citrate liver scintigraphy will correctly identify 94% of all primary hepatic tumors.

**Radioimmunoassay of Secretin in Human Plasma.** L. E. Hanssen and P. Torjesen. *Scand J Gastroenterol* 12: 481-488, 1977.

The authors describe reagent preparation, test methodology, and clinical use of their radioimmunoassay (RIA) for plasma immunoreactive secretin (IRS). Synthetic secretin was labeled with I-125. Standards were prepared from porcine secretin, and antiserum was rabbit anti-synthetic (Squibb)-secretin. Radioimmunoassay procedure involved incubation at 4°C for 2 days of either the standards or the plasma extract plus antiserum followed by addition of I-125 secretin and a further refrigerated incubation for 4 hours. Bovine immunoglobulin and polyethylene glycol were then added and centrifuged to separate bound from free hormone. Radioactivity was determined in an automatic gamma scintillation spectrometer. Plasma IRS levels were measured in five healthy young people who had been supine for one-half hour. After a 30-min basal period, each subject underwent duodenal acidification for 5 min. The IRS levels increased significantly from the basal level of  $4.5 \pm 0.5$  pmole/l (mean  $\pm$  s.e.) to  $19.5 \pm 7.5$  pmole/l. Pancreatic flow rate increased from  $0.5 \pm 0.1$  ml/min to  $4.8 \pm 0.5$  ml/min with a bicarbonate output increase of from  $9.6 \pm 1.8$   $\mu$ mole/min to 268  $\mu$ mole/min after duodenal acidification.

The method described measures circulating IRS levels in man. It was found that the extraction performance of I-125 secretin was remarkably constant in different plasma samples. The limit of detection was found to be 2.5 pmole/l plasma, with between-assay and within-assay precision of 15% and 10%, respectively, at 17 pmole/l.

**Radioimmunoassays for Methotrexate, Citrovorum Factor, Neocarcinostatin, and Actinomycin-D.** V. Raso. *Ca Treatment Reports* 61: 585-590, 1977.

The author describes his radioimmunoassays (RIA) for cancer chemotherapeutic drug levels in patient sera. The

assay for methotrexate (MTX) had a sensitivity of 0.1-1 pmole drug, depending on antiserum employed. Folinic acid (citrovorum factor) did not significantly interfere in the assay. That fact is important when measuring MTX levels in patients receiving high-dose MTX therapy in combination with citrovorum factor rescue. Also, the antisera could be employed to measure aminoprotein concentrations. The assay for citrovorum factor had a sensitivity of 0.2 pmole and neither folic acid nor MTX levels interfered significantly. Kinetics of citrovorum factor disappearance from serum have been studied following oral and i.v. administration of drug in normals and in MTX-treated patients. The assay for neocarcinostatin, a cytotoxic polypeptide, demonstrated sensitivity of 0.3 pmole. The actinomycin-D RIA is used to help achieve therapeutic levels of the drug while avoiding excessive toxicity. This assay could detect as little as 1 pmole added drug.

**Calibration and Evaluation of a System for Total Body in vivo Activation Analysis using 14 MeV Neutrons.** E. D. Williams, K. Boddy, I. Harvey, and J. K. Haywood. *Phys Med Biol* 23 (3): 405-415, 1978.

A system is described for determining the total body contents of calcium, phosphorus, sodium, chlorine, and nitrogen by neutron activation analysis using sealed-tube neutron generators and a shadow-shield whole body counter. The system was calibrated using three anthropomorphic phantoms of different sizes, filled with various mixtures of the activable elements in amounts similar to those in man. The reproducibility, determined from replicate measurements, was  $\pm 2.9\%$  (SD) on average. The average uncertainty in absolute measurements was estimated to be  $\pm 4.2\%$  (1 s.d. level).

**Clinical Value of the Bile Acid Breath Test.** B. H. Lauterburg, A. D. Newcomer, and A. F. Hofmann. *Mayo Clinic Proc* 53: 227-233, 1978.

The authors reported on 228 bile acid breath tests in 219 patients examined over a period of nearly 5 years. Bacterial overgrowth was suspected in 163 patients, bile acid malabsorption in 37, and a variety of underlying diseases in the remainder. After an oral dose of [<sup>14</sup>C]-cholyglycine, the specific activity of expired <sup>14</sup>CO<sub>2</sub> was determined at hourly intervals. The test was considered abnormal if the exhalation of <sup>14</sup>CO<sub>2</sub> at 2 or 4 hr (or both) exceeded the maximal values—50 units at 2 hr and 143 units at 4 hr—as determined in healthy subjects. The unit for <sup>14</sup>CO<sub>2</sub> excretion in breath is the percentage of the dose per millimole CO<sub>2</sub> exhaled  $\times$  body weight in kg  $\times$  100. In those patients with suspected bacterial overgrowth, the result of the bile acid test was compared with that of culture from aspirates of the small bowel, and the test was found to have a sensitivity of 0.70 and a specificity of 0.90 (1.0 highest possible value). Although the bile acid test failed to demonstrate bacterial overgrowth in one third of the patients with positive small bowel culture, analysis of the data by Bayes theorem showed that, compared with the small bowel culture alone, the breath test results would double the probability for the clinician in determining the absence or presence of bacterial overgrowth. The test result seemed to influence the diagnosis in 83% and the management in 74% of the 163 patients suspected of bacterial overgrowth. On the other hand,

in those patients with suspected malabsorption of bile acids, the breath test was rather insensitive if obtained without the determination of fecal bile acid excretion. Only rarely was the information gained from the breath test not already known from the routine workup of the patient.

**Imaging Platelet Deposition with In-111 Labeled Platelets in Coronary Artery Bypass Grafts in Dogs.** M. K. Dewanjee, V. Fiester, M. P. Kaye, and M. Josa. *Proc Mayo Clinic* 53: 327-331, 1978.

Aorta-left anterior descending coronary artery bypass graft with the right saphenous vein was performed in four mongrel dogs. Coronary angiography was performed 24 hr after surgery. Autologous platelets were labeled with In-111 8-hydroxyquinoline (oxine) during surgery. Three to five hundred  $\mu$ Ci were administered intravenously to the dogs 2 hr after the operative procedure. At approximately 6 and 30 hr following the bypass, the torsos of the dogs were imaged in the anterior, left and right lateral, and left and right anterior oblique positions. Pinhole views of the graft were also obtained. After imaging, the dogs were killed and biodistribution of radioactivity determined. The isolated hearts were imaged with the chamber blood present and then imaged after opening and washed clean of blood. The bypass grafts were removed and radioactive concentration measured. Scintimaging in the viable dogs revealed a concentration of radioactivity in the grafts, greater at 30 hr as compared to 6 hr; however, the greatest concentration was found in the liver and spleen. Imaging of the isolated hearts confirmed the in vivo findings. In vitro measurement of radioactivity demonstrated graft/blood of four to 15 times and graft/normal myocardium of 25 to 100 times.

**Dual Radionuclide Study of Acute Myocardial Infarction.** H. J. Berger, A. Gottschalk, and B. L. Zaret. *Ann Int Med* 88: 145-154, 1978.

In 80 patients with documented acute myocardial infarction (55 transmural and 25 nontransmural infarction), the authors evaluated dual imaging with thallium-201 and technetium-99m pyrophosphate (Tc-PPi). The Tc-PPi studies were obtained within 12 days from the onset of symptoms, and the Tl-201 studies were obtained within the first 14 days of infarction. Fifteen mCi of Tc-99m pyrophosphate were injected intravenously 1-2 hr before imaging and 2 mCi of Tl-201 10 min prior to imaging. Patients were imaged in the anterior and 45° left anterior oblique positions, and all images were corrected for detector nonuniformity with a computer. For both Tl-201 and Tc-99m images, 30-40% background subtraction was routinely used, and the remaining 60-70% of activity was displayed in 16 shades of colors. In 16 patients the color-coded isocount display of Tl-201 images was essential for interpretation. Combined Tl-201 and Tc-99m imaging for infarct detection was 100% sensitive. Both were falsely negative, however, in 12 of 80 patients. The false-negative images with either Tl-201 or Tc-99m were most commonly observed in patients with small infarcts or left ventricular hypertrophy. Thallium-201 images correctly localized the site of acute transmural infarction in all 51 patients with a positive image, whereas Tc-99m localized the site of infarction in 49 of 53 with an abnormal image. Comparison of the size of the imaged infarct region revealed size discordance in 25 of 49 patients, in 21 of 49 larger by Tc-99m pyrophosphate images and only four of 49 larger by Tl-201 images.

**Myocardial Perfusion Scintigraphy in Patients with Mitral Valve Prolapse—Its Advantages over Stress Electrocardiography in Diagnosing Associated Coronary Artery Disease and Its Implications for Etiology of Chest Pain.** B. Massie, E. H. Botvinick, D. Shames, M. Taradash, J. Werner, and N. Schiller. *Circulation* 57: 19-26, 1978.

The authors performed treadmill exercise tests and relative myocardial perfusion scintigraphy in 25 patients who had confirmed mitral valve prolapse (MVP) and who underwent cardiac catheterization for evaluation of chest pain. Each patient had signs of mitral valve prolapse on physical examination (nonejection midsystolic clicks in 21, apical systolic murmurs in 20), and the diagnosis of mitral valve prolapse was confirmed by echocardiography (19 patients), left ventricular cineangiography (23 patients), or both (17 patients). Two mCi of rubidium-81 (in the first three patients) or thallium-201 (in all subsequent patients) were injected intravenously as the exercise end point approached, and exercise was continued for 30-45 sec. Anterior, 45° left anterior oblique and left lateral images were completed within 30 min of injection. Patients with abnormal scintigrams returned 1 wk later for perfusion scintigraphy at rest to differentiate stress-induced ischemia from previous myocardial infarction. Apical "slit-like" defects were classified as abnormal only if they appeared at rest. Stress electrocardiograms were not helpful in diagnosing associated coronary artery disease, primarily because of a high incidence (53%, 10/19) of false positive tests, and it had only a 48% overall accuracy. Scintigraphy was more accurate ( $P < 0.001$ ), correctly classifying all patients, and was uniformly negative in patients with normal coronary arteriograms. This suggests that ischemia, if present as the cause of chest pain and ECG changes, must be either very localized, such as in a papillary muscle beyond the resolution of the imaging, or generalized, resulting from an undetectable homogenous decrease in myocardial perfusion by the scintigraphy.

**Radionuclide Angiography in Cerebral Vascular Processes.** G. Kirsch, K.-O. Kagel, and B. Streckenbach. *Radiol Diagn* 19 (II): 116-125, 1978.

The authors compared the results of scintigraphy with those of radionuclide angiography (RNA) in four patients with cerebral arteriovenous malformations, and in 18 patients with cerebrovascular accidents. A control group—30 persons without cerebral abnormality—are included in the study. Fifteen of the 22 patients had cerebral angiography. A gamma camera was used in the studies. A minicomputer and a visual display unit were used to handle and evaluate the data. After the i.v. injection of 5-15 mCi Tc-99m pertechnetate, scintigrams of 1 sec duration were made at the beginning of the study. Thirty minutes to 3 hr after isotope application scintigrams in either three or four standard projections were made. Identical regions of interest (ROI) were placed over both hemispheres, and time-activity curves were generated. The curve analysis compared peak time and peak amplitude of the corresponding regions. In corresponding regions, the authors found peak amplitude values in normals to differ by  $4.3 \pm 2.7\%$ . Peak time differences in normals did not exceed 1 sec. Three out of four arteriovenous malformations were visualized in the scintiphoto scans. All four malformations were identified in RNA. Regions of interest containing vascular malformations had curve amplitudes 2 to 5 times greater than corresponding ROI. Six of 18 cerebrovascular accidents were not visual-

ized scintigraphically or in RNA. In these patients the onset of the illness generally exceeded 4 weeks. On six occasions both scintigram and RNA were positive. Four lesions were seen in RNA only and two in the scintigram only. Eight times the time-activity curve generated over the lesion of the vascular accident had an amplitude depression and a delayed  $T_{max}$ , and two curves had only an amplitude reduction. The authors conclude that the probability of detecting vascular malformations and lesions due to vascular accidents, is increased when scintigraphy is augmented by RNA.

**Preoperative Evaluation for Pulmonary Resection-Role of Radionuclide Lung Scanning.** S. S. Lefrak. *Chest* 72: 419-420, 1977.

This editorial stressed the important role of radionuclide lung scanning in the preoperative evaluation of the patient with bronchogenic carcinoma, particularly its contribution to the physiologic evaluation of high-risk patients. The evaluation should identify those patients who have anatomically resectable tumors and in addition who are able to tolerate the physiologic impairment that results from a pulmonary resection. If the FEV<sub>1</sub> (forced expiratory volume in 1 sec) after pneumonectomy was predicted to be greater than 800 ml, as estimated by spirometric data and radionuclide (Xe-133) scanning, the patient was considered a candidate for pneumonectomy. It has been suggested that if the lung that contains the carcinoma receives less than 33% of the total perfusion, the tumor is usually nonresectable. All patients in this report had perfusion to the contralateral lung of greater than 50% of the total, the mean being 67%.

**Hypertensive Pulmonary Vascular Disease in Children. Detection by Radioactive Nitrogen (<sup>15</sup>N) Inhalation and Injection.** S. A. McKenzie, C. G. C. MacArthur, S. Godfrey, and K. A. Hallidie-Smith. *Brit Heart J* 39: 866-871, 1977.

Regional lung function was studied in 16 children with intracardiac shunts and a variety of associated cardiac anomalies using radioactive nitrogen (N-13 → cyclotron producer with 10 minute half life) and a gamma camera-computer system. The pulmonary:systemic resistance ratio (Rp/Rs) was calculated by the standard technique using the pulmonary arteriolar resistance in the numerator. For the study of ventilation, a 4-ml bolus of N-13 gas was delivered at end-expiration into the nasopharynx through an infant feeding tube or a mouthpiece. For this study of pulmonary perfusion, a bolus of N-13 was dissolved in 4 ml isotopic saline and was injected rapidly from an indwelling needle into an arm vein. During and after each administration of isotope the lungs were scanned continuously by a gamma camera for 5-10 min and the data processed with the aid of a digital computer. Activity time curves were plotted for each lung zone and indices of regional lung function calculated. The distribution and washout of inhaled N-13 were usually normal. The distribution of intravenously injected N-13 was often abnormal and could be related to local anatomy. In children with an abnormally raised pulmonary/systemic vascular resistance ratio at cardiac catheterization, the most important finding was delayed ventilatory clearance of intravenously injected N-13. The regional localization of this ventilation-perfusion imbalance in several children could be related to the probable distribution of hypertensive pulmonary vascular disease, predicted either from local anatomy as demonstrated by cardiac catheterization or from the abnormal distribution of pulmonary perfusion. Abnormalities present on breathing air may be partially reversed on breathing 100% oxygen.

**Value of Preoperative Radionuclide Bone Scan in Suspected Primary Breast Carcinoma.** M. J. O'Connell, H. W. Wahner, D. L. Ahmann, A. J. Edis, and A. Silvers. *Mayo Clinic Proc* 53: 221-226, 1978.

The authors examined 100 female patients with suspected (91) or known (nine) carcinoma of the breast by whole body scintigrams with technetium-99m diphosphonate, pyrophosphate, or polyphosphate. The scans were interpreted as abnormal if the intensity of a lesion exceeded that in the major joints, or equivocal if less; the lesions were recorded as single, two, or multiple; and the abnormal or equivocal sites were compared with the roentgenograms. Bony metastases were considered established if the roentgenogram findings were compatible, if a bone biopsy were positive, or if subsequent evidence were positive. Preoperative evaluation classified the patients as: Stage I, 56 patients; Stage II, 32 patients; and Stage III, 12 patients. After biopsy the pathologic stages were classified as: Stage I, 30 patients; Stage II, 42 patients; Stage III, 13 patients; and benign, 15 patients. Serum levels of alkaline phosphatase were normal in 99 of patients and moderately elevated in the remaining one who had had an osteotomy 6 mo previously. Thirty-four patients revealed definite (12) or equivocal (22) abnormalities on the radionuclide studies. In 22 cases the lesions were single, in two cases were two, and in ten cases, multiple. In nine of the ten patients with multiple lesions, the scan sites were considered equivocal. No relationship was established between the clinical grading of the breast carcinoma and the scintigram findings. Of 12 patients with definite abnormalities on the bone scan five were documented on the roentgenograms. Three of these patients had benign breast lesions, two of which were observed on radiographs. In the authors' series the low percentage of unexplained definitely abnormal bone scan lesions in patients with proven carcinoma of the breast (five of 85 patients, 6%), probably reflects the high percentage of early-stage primary breast lesions. The authors conclude that the bone scan should be considered preoperatively in those patients who present with suspected breast carcinoma and unexplained significant bone pain.

**Sonographic Demonstration of Intrauterine Contraceptive Devices.** I. Watt, E. Watt, M. Halliwell, and F. G. M. Ross. *J Clin Ultrasound* 5: 378-382, 1977.

A series of 77 patients was examined, in 55 of whom intrauterine contraceptive devices were thought to be in place. B-scans in both longitudinal and transverse planes yielded an accuracy of 95% in the correct identification of presence or absence of the IUCD. A-mode scans were used as well, and the uterine wall-to-cavity ratio measured. In those patients with an IUCD present, the uterine wall-to-cavity ratio was  $1.32 \pm \text{s.d. } 0.41$ ; in the volunteers without IUCD's the wall-to-cavity ratio was  $7.19 \pm \text{s.d. } 2.46$ . Overall accuracy of identification of the type of IUCD was 65%; 78% accuracy was achieved with a Lippe's Loop and 13% with a Dalkon shield. Ultrasonography, both A and B scans, represents a highly accurate, noninvasive means for determining the presence or absence of intrauterine contraceptive devices.

**Gray Scale Ultrasonography of the Gallbladder: An Evaluation of Accuracy and Report of Additional Ultrasound Signs.** J. C. Anderson and R. K. Harned. *Am J Roentgenol* 129: 975-977, 1977.

In a study of 76 patients the overall accuracy of ultrasound in detecting gallstones was found to be 89%. In a high proportion of gallbladders not visualized at ultrasonog-

raphy (13 out of 76), stones were ultimately found. The authors describe a target-shaped echo pattern discovered in the region of the cystic duct and representing impaction of a calculus within the duct. A second case is presented in which a fluid collection was identified in the lesser sac and ultimately found to be a collection of bile. The authors recommend that ultrasonography be performed as a supplementary examination in the patient with a nonvisualized oral cholecystogram.

**Ultrasonographic Appearance of Gas-Containing Abscess in the Abdomen.** H. Y. Kressel and R. A. Filly. *Am J Roentgenol* 130: 71-73, 1978.

In addition to the classic ultrasonographic appearance of abscesses as sonolucent masses, the authors describe six gas-containing abdominal abscesses, which presented as densely echogenic masses with acoustical shadowing, or simply echogenic masses, or regions of acoustical shadowing alone. The explanation proposed is that of "microbubble" contrast effect producing the echogenicity in such cases. Examples are cited of such gas-containing abscesses in the retroperitoneum, anterior abdominal wall, and within the hepatic parenchyma itself. The diagnosis cannot be readily made within the peritoneal cavity; however, an appearance suggestive of a gas collection in the retroperitoneum, liver, or anterior abdominal wall should suggest the possibility. Calcified lesions, masses with much fibrous stroma, and hair-containing teratomas may merit consideration in the differential diagnosis.

**Sonography of the Common Bile Duct: Value of the Right Anterior Oblique View.** M. Behan and E. Kazam. *Am J Roentgenol* 130: 701-709, 1978.

The authors report an overall accuracy of 96% in de-

tecting dilatation of the common duct in a series of 101 consecutive cases proven at surgery, autopsy, or cholangiography. The method used involves elevation of the patient's right side with direction of the beam postero-medially and scanning in either a straight longitudinal or slightly oblique position. Scanning is conducted until two tubular structures are demonstrated in the porta hepatis, the posterior one is the portal vein, and the anterior, the common bile duct. The upper limits of normal in the sonographic evaluation of the common duct is 8 mm at its widest diameter. The method described for identification of the common duct does not depend upon such previously described variables as pulsations, continuity with other venous structures such as the splenic vein and a comma-shaped configuration of the duct. An additional advantage of the method is the displacement of bowel gas and the utilization of the liver as an acoustic window into the structures of the porta hepatis. Identification of stones within the common duct can also be made by this method. Evaluation of the intrahepatic biliary radicles is important in assessing conditions that may produce dilatation of these radicles in the face of a normal size common duct. Mild dilatation of the duct is normally seen in a patient who has undergone cholecystectomy.

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#### BOOKS RECEIVED

The receipt of the following books is acknowledged:

*Computer Methods: The Fundamentals of Digital Nuclear Medicine*, David E. Lieberman, 225 pp, illustrated. Saint Louis, The C.V. Mosby Company, 1977. \$13.95.

*Medical Physics*, John R. Cameron and James G. Skofronick. 615 pp, illustrated. New York-Chichester-Brisbane-Toronto, John Wiley & Sons, 1978. \$21.95.

*Care of the Patient in Diagnostic Radiography*, D. Noreen Chesney and Muriel O. Chesney. 323 pp, illustrated. Oxford-London-Edinburgh-Melbourne, Blackwell Scientific Publications, 1978. \$20.00

*Intermediate Physics for Medicine and Biology*, Russell K. Hobbie. 557 pp, illustrated. New York- Santa Barbara-Chichester-Brisbane-Toronto, John Wiley & Sons, 1978. \$21.95.