

ABSTRACTS OF CURRENT LITERATURE

Mechanisms Contributing to Myocardial Accumulation of Technetium-99m Stannous Pyrophosphate after Coronary Arterial Occlusion. R. E. Coleman, M. S. Klein, S. A. Ahmed, E. S. Weiss, W. M. Buchholz, and B. E. Sobel. *Am J Cardiol* 39: 55-59, 1977.

In normal dogs the left anterior descending coronary artery was occluded for intervals ranging from 10 min to 24 hr producing ischemia or infarction. Serum samples taken preoperatively and hourly for 24 hr postoperatively were assayed for MB creatine kinase (CK) isoenzyme activity. At 48 hr postocclusion, 3 mCi of Tc-99m Sn pyrophosphate (Tc-PPi) was given intravenously. Myocardial scintigrams, performed 1 hr later, were interpreted by the investigator who was unaware of the duration of occlusion. If the coronary artery occlusion was less than 20 min, CK activity was unchanged from base line and scintigrams were normal. Occlusions for 34 min or longer yielded consistently increased CK activity and abnormal images in five of seven animals.

Tc-PPi and 500 μ Ci [32 P] pyrophosphate were administered simultaneously to either nonleukopenic or leukopenic (following cyclophosphamide) dogs that had undergone persistent coronary occlusion. Comparable concentrations of the two radioactive materials were found in the normal and the infarcted heart mitochondria and in whole myocardium. In both leukopenic and nonleukopenic animals receiving only Tc-PPi, all animals demonstrated abnormal myocardial images 24 hr after coronary occlusion and 1 hr following radiopharmaceutical injection. Concentration of radioactivity in whole homogenates of infarcts and in mitochondria extracted from infarcts surpassed that in corresponding fractions of normal tissues.

Since abnormal myocardial images were found to occur in the presence of leukopenia, the authors felt that Tc-PPi deposition was not dependent on "phagocytosis" of radiopharmaceutical by white cells migrating into infarcts. Incorporation of Tc-99m into infarcts appeared related to and in association with bound pyrophosphate in many subcellular loci rather than in mitochondria alone.

Imaging of Acute Myocardial Infarction Using Technetium-99m Labeled Phosphate Compounds. G. D. Kerr, A. Pitt, C. C. Wong, L. M. Dugdale, and S. T. Anderson. *Australian and New Zealand J Med* 7: 1-7, 1977.

Forty-four patients with a provisional diagnosis of a recent myocardial infarction were imaged with 15 mCi of Tc-99m polyphosphate or pyrophosphate by gamma camera. Thirty-nine of 41 patients with acute infarction were scanned within 6 days of the acute episode, and in all, the scintigram was positive. The two negative scintigrams were obtained in patients imaged at 7 and 9 days after infarction, respectively. Five patients had myocardial ischemia with compatible ECG changes, and had no abnormal myocardial enzymes. All had scintiscans within 6 days and all were negative. Transmural infarction was present in 29 of the 39 patients with positive images; seventeen were anterior and 12 inferior by ECG criteria. Subendocardial infarction was diagnosed in six patients on the basis of evolving S-T

changes and myocardial enzyme elevations followed by a return to normal levels. All patients were imaged within 6 days of acute event and all showed small areas of abnormal radionuclide concentration. The area of abnormal uptake was subjectively graded into small, medium, and large, and this grading correlated well with the degree of myocardial necrosis as indicated by the mean peak myocardial enzyme estimations. No significant difference was noted between Tc-99m pyrophosphate and polyphosphate in their imaging efficiency.

99m Technetium Penicillamine: Renal Cortical Scanning Agent. A. Taylor, G. Davis, S. Halpern, and W. Ashburn. *J Urol* 117: 418-420, 1977.

Tc-99m penicillamine (TPEN) was used by these authors on several hundred patients who had been referred for renal scans over a 3 yr period. Results with five representative patients were described. In order to assess vascular supply of the kidney following i.v. administration of 5-10 mCi TPEN, scintiphotographs were made over kidneys at 2-sec intervals as the initial bolus traverses abdominal aorta and renal arteries (radionuclide renal angiogram). One hour later static images were obtained with a gamma camera and a parallel hole, converging, or pinhole collimator. In most cases, an [131 I] iodohippurate renogram complemented the study.

In this patient sample, TPEN revealed the actual normality in a case of suspected pyelonephritis, and it demonstrated cases of renal cell carcinoma, pelvic kidney, hydronephrosis secondary to calculi, and renal fibrosis with chronic inflammation. Accompanying excretory urograms and aortograms were depicted. TPEN was excreted relatively slowly in urine during the imaging procedure thus preserving cortical image quality by eliminating a superimposed collecting system. Magnification with pinhole collimator views provided better delineation of detail. Delayed scans permitted correlation with continued renal accumulation of radiopharmaceutical and corresponding blood clearance. Anatomic detail with TPEN was reported superior to that obtained with [131 I] iodohippurate.

Significance of Unilateral Diminished Activity in Renal Scanning. K. G. Rai and V. J. Sharpe. *Can J Surg* 20: 245-248, 1977.

The authors attempted to correlate the results of renal scanning with the findings from i.v. pyelogram (IVP) and final patient diagnosis. Rectilinear scanning was performed 4-6 hr after the injection of 400 μ Ci of Hg-197 with the patient in a prone position. In 25 cases, unilateral diminished activity was found by renal scanning. In nonmass lesions (15 cases) of the kidney the renal scan correlated well with the IVP and the final diagnoses (three congenital renal absences, three renal artery stenosis, one crossed ectopia, two renal hypoplasia, one renal contusion, and five hydronephrosis). In mass lesions (ten cases), a diminished uptake of isotope corresponding to the site of the lesion seen on the IVP was suggestive of a cyst (four cases); diminished uptake of isotope in the whole kidney including the mass lesion

on the renal scan was suggestive of renal carcinoma (six cases). The authors feel that if more changes are seen by renal scanning than by IVP and if a generalized diminished uptake of the isotope remains in the kidney as well, carcinoma of the kidney must be considered very likely.

Localization Diagnostics of Malignant Tumors Using Radioactive Bleomycin. H. B. Makoski. *Strahlentherapie* 153: 331-341, 1977.

Total body scintigraphy with ¹¹¹In-bleomycin (50 μCi/kg B.W.) was performed in 66 patients with malignant solid tumors and lymphomas. In 38 of 66 (58%) cases, positive information was correct. In 12 of 66 (18%), scintigraphic information was correctly negative. With 16 out of 66 (24%), false positive or false negative information was obtained.

Carcinoembryonic Antigen (CEA) Activity in Pancreatic Juice of Patients with Pancreatic Carcinoma and Pancreatitis. M. P. Sharma, J. A. Gregg, M. S. Loewenstein, R. P. McCabe, and N. Zamcheck. *Cancer* 38: 2457-2461, 1976.

This study measured carcinoembryonic antigen (CEA) in plasma and in secretin-stimulated pancreatic juice (obtained during transduodenal pancreatic duct cannulation) by Hansen Z-gel radioimmunoassay. Thirteen symptomatic patients with no demonstrable pancreatic disease had plasma CEA levels of 0-13 ng/ml (mean 1.7) and pancreatic juice levels of 5.5-12.4 ng/ml (mean 8.1). In 28 patients with pancreatitis, plasma CEA was found to be 0-6.6 ng/ml. Eight patients with pancreatic cancer had plasma CEAs of 1.4-270 (mean 40.7) ng/ml and pancreatic juice level of 9.2-2000 (mean 309) ng/ml. No relationship could be established between the CEA level of plasma and that of pancreatic juice within an individual. Of 32 patients who had both a plasma CEA less than 2.5 ng/ml and a pancreatic juice CEA less than 30 ng/ml, none had pancreatic cancer. Simultaneous elevations of CEA in both the pancreatic juice and plasma favored a diagnosis of cancer in patients with pancreatic disease. If the CEA levels were normal in both fluids, these findings provided strong evidence against cancer. An increase of the CEA level in either plasma or pancreatic juice was not diagnostic of either tumor or pancreatitis but mandated further evaluation.

A Radioimmunoassay for Measurement of 3,3'-L-Diiodothyronine (T₂). S. Y. Wu, I. J. Chopra, Y. Nakamura, D. H. Solomon, I. R. Bennett. *J Clin Endocrin Metab* 43: 682-685, 1976.

The authors described the clinical application of a radioimmunoassay (RIA) procedure for the determination of 3,3'-L-diiodothyronine (T₂) in serum and amniotic fluid. Three ml of the test sample were extracted with ethanol and the mixture then centrifuged. After an aqueous solution of the supernate was lyophilized, the residual powder was dissolved in barbital buffer and centrifuged. A quantity of the latter supernate (representing 0.83 ml test sample) was used in the RIA. Of the thyroid hormone analogues, 3-L-moniodothyronine alone competed with ¹²⁵I-T₂ for antibody binding sites. The assay had a sensitivity of 1.2 ng/dl serum.

T₂ was detectable in the serum of all 44 normal subjects studied: 7.6 ± 2.4 ng/dl (mean ± sd). In patients with hypothyroidism, in pregnant women, and in patients with cirrhosis, mean serum levels were in the normal range. Patients with hyperthyroidism demonstrated significantly higher levels, 20.2 ± 7.5 ng/dl, as did newborns, 16.4 ± 3.8. Measurement of T₂ in amniotic fluid at 15-16 wk

gestation (4.1 ± 0.9) were significantly lower than at term (10.9 ± 2.9). Following the administration of a single dose of either L-triiodothyronine (T₃) or of L-reverse-T₃, a measurable rise in T₂ was observed. The authors concluded that T₂—the physiological importance of which is unknown at this time—was a normal component of human serum and amniotic fluid. The peripheral metabolism of T₃ and reverse-T₃ to form T₂ contributed significantly to levels of T₂ detected.

Value of Radiochromium Investigation in Autoimmune Haemolytic Anemia. A. C. Parker, A. I. S. MacPherson, and J. Richmond. *Brit Med J* 1: 208-209, 1977.

Following the i.v. administration of Cr-51 labeled erythrocytes, radioactivity concentrations over the spleen and liver were determined in vivo in 12 patients with hemolytic disease. Spleen-to-liver uptake (S:L) ratios were computed at the half-time of Cr-51 residence in circulation after injection (T_{1/2} Cr-51). Currently, it is felt that splenectomy proves beneficial when that spleen-to-liver ratio is 2.5. A spleen sequestration index or SSI (i.e., percentage increment in spleen-to-heart radioactivity from time of injection to T_{1/2} Cr-51) over 100 is thought to reflect moderate to severe splenic red cell sequestration. Half the patients were able to discontinue corticosteroids within 2 mo after splenectomy, indicating that the procedure was successful. The correlation between splenic uptake of radioactivity and outcome of subsequent surgery was poor. No relationships could be established among SSIs, S:L ratios, and the result of splenectomy. In the patients studied, IgG sensitized the red cells of those subjects who responded favorably to surgery, whereas only complement was involved in the non-responders. From this small patient sample, the authors concluded that in vivo Cr-51 red cell spleen-to-liver measurements were not reliable predictors of the success of splenectomy for the treatment of autoimmune hemolytic anemia.

Radiations Emitted in the Decay of ¹⁶⁶Er: A Promising Medical Radionuclide. D. V. Rao, G. J. Hallee, M. E. Ohtlinger, K. S. R. Sastry. *Medical Physics* 4: 177-186, 1977.

The development of multiwire proportional counters as imaging devices has created a need for photon emitters in the 50 keV range, and one that appears promising is Er-165. This article describes the methods used in determining the nuclear parameters associated with the decay of Er-165 and lists its physical properties. A Si (Li) photon spectrometer was used to determine the L & K x-ray photon yields. The half-life of Er-165 is 10.3 hr, and it decays by electron capture to stable Ho-165. K x-ray energies range from 46.7 to 55.3 keV with a collective abundance of 75.6%. Since the material used in the study was reactor produced, it consequently had a number of impurities and the quantities of these are noted in the paper. The whole-body radiation dose was calculated to be comparable to Tc-99m for equal activities. Interestingly, Er-165 exhibited significant uptake in rat tumors.

Ultrasound Scan in Diagnosis of Peripheral Aneurysms. R. P. Davis, H. L. Neiman, J. S. T. Yoo, and J. J. Bergan. *Arch Surg* 112: 55, 1977.

Twenty subjects without known disease were examined to establish the normal adult femoral and popliteal artery dimensions; the femoral artery diameter was found to be 1.1 ± 0.3 cm and the popliteal 0.9 ± 0.2 cm. In nine patients with 13 peripheral aneurysms, femoral aneurysms

ranged in size from 2.0 to 5.2 cm; popliteal aneurysms from 1.5 to 3.5 cm. Intraluminal thrombus was demonstrated by ultrasound; however, complete thrombosis could not be differentiated from total patency. Although disagreement exists in the literature concerning the accuracy of physical examination and arteriography in the evaluation of peripheral aneurysms, the present study indicates that when a peripheral aneurysm is present, it can be detected by physical examination and may be confirmed by ultrasonic scan. Ultrasonography proved more accurate than physical examination in determination of aneurysm size, and when a clinically suspected aneurysm could not be confirmed by ultrasonography, the absence of aneurysm proved correct. The authors emphasize the importance of the demonstration of thrombi within aneurysms and suggest that the presence of clots supports the possibility that embolization to distal small arteries does occur in patients with popliteal artery aneurysms. The ultrasonographic technique was recommended as a safe, noninvasive method of confirming the presence and accurately determining the size of an aneurysm and was a valuable long-term followup procedure in the patient who is a poor surgical risk.

Localization of Abdominal Masses Using Ultrasound for Radiation Therapy. R. S. Dhaliwal, A. R. Antuneq, and L. Gonzales. *OH S Med J* 73: 69, 1977.

To avoid the local failures after radiation therapy, attributed to geographic miss of the tumor on the basis of poor localization, the authors described ultrasonographic techniques for designing treatment portals. A detailed description of portal design by ultrasound for the radiotherapy of carcinoma of the prostate was presented; ultrasonic scanning was performed after the anterior pelvic field was designed and marked on the patient's abdomen. Patient contour was directly transferred into a computer that was interfaced with the ultrasound unit and a computer dosimetry printout displayed. Similarly, in carcinoma of the pancreas ultrasound was used to identify portions of the tumor that may extend beyond clinical recognition, thereby permitting design of therapy portals to include the entire neoplasm. The method allowed more thorough radiation coverage of tumor mass and maximum possible sparing of adjacent organs.

Hepatic Abscess: Ultrasound as an Aid to Diagnosis. T. L. Lawson. *Dig Dis* 22: 33, 1977.

The use of ultrasonography complementary to the radionuclide evaluation of the liver was illustrated by presentation of a case of multiple intrahepatic abscesses. The Tc-99m scan demonstrated mild hepatomegaly and multiple defects. The ultrasonographic study outlined these defects as sonolucent areas, predominantly in the right lobe, and surgery identified these defects as multiple hepatic abscesses. Parenchymal lesions as small as 2-3 cm in diameter are now within the province of hepatic ultrasonography and defects identified at radionuclide scanning can be further evaluated by this method. The techniques are complementary and supplement one another in their respective weaknesses. The author discusses the technique of hepatic biopsy under ultrasonographic guidance employing a biopsy transducer.

Ultrasonic and Radiographic Cholecystography. R. J. Bartrum, H. C. Crow, and S. R. Foote. *N Eng J Med* 296: 538, 1977.

A study of 208 patients compared and correlated the results of oral cholecystography and ultrasonic examination of the gallbladder, and the authors found an overall accuracy for the ultrasonic examination in 93%; the false-negative rate was 11% and an indeterminate rate, 4%. The indeterminate rate for single dose cholecystography was 24%; that for double-dose studies was 8%. In 87% of the patients studied, the same diagnosis was obtained by both methods; 14 of the 15 patients with no diagnosis from the radiographic study (8%) were correctly diagnosed by ultrasound (confirmed by surgery). The method was considered quite specific with a false-positive rate of less than 1%, but only moderately sensitive with a false-negative plus indeterminate rate of 15%. The authors recommend single dose cholecystography as the initial procedure of choice with immediate ultrasonography if the gallbladder status was indeterminate. In pregnant patients with suspected processes such as acute cholecystitis or pancreatitis, ultrasonography was recommended as the first examination.

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BOOKS RECEIVED

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First European Symposium on Rad-Equivalence. Proceedings of the Seminar on Radiobiology-Radiation Protection-Orsay (France) 24-26 May 1976. R. Chanet, ed. 265 pp, illustrated. Luxembourg, Commission of the European Communities, 1977.

Seminar on the Radiological Protection problems Presented by the Preparation and Use of Pharmaceuticals Containing Radioactive Substances, 130 pp. Luxembourg, Commission of the European Communities, 1977.

Nuclear Medicine: Clinical and Technological Bases, J. T. Andrews and M. Jean Milne. 468 pp, illustrated. New York-London-Sydney-Toronto, John Wiley & Sons, Inc. \$25.00.

Physical Techniques in Medicine, Volume 1, J. T. McMullan, ed. 318, illustrated. London-New York-Sydney-Toronto, John Wiley & Sons Ltd., 1977. \$25.50.