ABSTRACTS OF CURRENT LITERATURE

Kinetics of Indium-111 Labelled Lymphocytes in Normal Subjects and Patients with Hodgkin's Disease. J. P. Lavender, J. M. Goldman, R. N. Arnot, and M. L. Thakur. *Brit Med J* 2: 797–799, 1977.

Lymphocytes were isolated from the heparinzed blood of four subjects (two normal men and two cases of confirmed Hodgkin's disease, stage IA, stage IIA) and labeled with In-111 using 8-hydroxyquinoline (oxine). The autologous labeled cells (200–500 μCi) with greater than 95% viability were injected into a peripheral vein and images were obtained (whole-body scanner and large field gamma camera) at intervals thereafter. After injection the radioactivity traversed the lung capillary bed slowly in a manner similar to that following the injection of labeled polymorphonuclear leukocytes. During the first 4 hr, increased radioactivity was observed in the spleen, liver, and bone marrow. From 19 to 26 hr, activity was seen in cervical, external iliac, and inguinal lymph nodes in all subjects. The lack of detectable activity in certain lymph node groups (e.g., para-aortic, axillary, internal mammary, and supraclavicular) may be due to anatomic and technical imaging factors or to preferential migration of labeled cells to immunologically "active" nodes. Patients with Hodgkin's disease (who received the larger radioactive doses) demonstrated mediastinal and hilar lymph nodes, also. Gut-associated lymphoid tissue was not seen. After 2 days, radioactivity diminished in all nodes. For both patients with Hodgkin's disease the concentration of radioactivity in those nodes felt to be clinically abnormal was not enhanced or depressed when compared with corresponding clinically normal nodes. In one normal subject and in one patient, the blood level of radioactivity decreased to 50% of the dose immediately after injection and to about 25% at 12 hr. Blood activity then rose slightly (presumably due to re-entry of labeled cells from the thoracic duct) and was followed by a much slower clearance. Because the In-111 label is firmly incorporated into cell cytoplasm, this method of tagging appears satisfactory for investigating lymphocyte kinetics.

Detection of Acute Myocardial Infarction by Radioimmunoassay for Creatine Kinase MB. Robert Roberts, C. W. Parker, and B. E. Sobel. *Lancet* 2: 319–322, 1977.

These authors employed their new radioimmunoassay (RIA) for MB isoenzyme of creatine kinase (myocardial isoenzyme or MB c.k.) in plasma from 100 healthy adults, from 20 patients with chest pain without myocardial infarction, and from 50 patients with transmural myocardial infarction. Sensitivity of the RIA was 0.01 mI.U. of enzyme activity per milliliter of plasma. In 83 normal controls levels of MB c.k. averaged 1 $\pm$ 0.6 mI.U./ml and 17 had no detectable levels. Patients with chest pain but without infarction demonstrated identical levels (1 $\pm$ 0.5 mI.U./ml). In all patients with documented infarction MB c.k. was elevated with peak levels of 97 $\pm$ 30 mI.U./ml. Each of 10 patients with infarction who were admitted within an hour after the onset of symptoms showed a prompt rise in MB c.k. with increases of 100% over baseline occurring before the total creatine kinase activity had exceeded the upper limit of normal. Since the sensitivity of conventional qualitative electrophoretic enzymatic MB assay is 10 mI.U./ml, such diagnostic procedures are inadequate for the early detection of slight elevations in MB c.k. The authors feel that this RIA should prove useful in the early detection of myocardial infarction. In addition the concepts included in reagent preparation and RIA procedure may be of value in the development of RIA's for other clinically significant enzymes that exist in multiple forms.

Staging Breast Cancer: Role of Bone Scanning. C. J. Davies, P. A. Griffiths, B. J. Preston, A. H. Morris, C. W. Elston, and R. W. Blamey. *Brit Med J* 2: 603–604, 1977.

Bone scans using 10 mCT of Tc-99m phosphate complexes and a rectilinear scanner, were obtained on 192 patients with primary breast cancer 4–6 wk after operation. The lymph node status of all patients was assessed histologically from triple node biopsy specimens. Almost half (49%) the patients had histologic evidence of metastatic tumor in the regional lymph nodes, although only nine patients had positive scans. On followup, 42 of the 183 patients (23%) with negative bone scans suffered from symptomatic recurrent disease. In contrast, only nine of the 98 patients (9%) with negative findings on lymph node histology experienced a symptomatic recurrence. Therefore, the authors questioned the value of bone scanning in the initial assessment of patients with probable early breast cancer. They feel that a bone scan serves mainly to confirm prognostic information obtained more simply and less expensively by histologic examination of lymph node biopsy specimens.

Detection of Hepatoma in Liver Cirrhosis. R. Moreau, F. Soussaline, S. Chauvaud, C. Parmentier, R. di Paola, P. Charbord, and M. Tubiana. *European Journal of Nuclear Medicine* 2: 183–188, 1977.

The detection of hepatomas in patients with liver cirrhosis is usually difficult using isotope methods, ultrasound, or CT scanning. The technique described by these workers shows promise in making this differential diagnosis easier.

Gallium-67 citrate and Tc-99m sulfur colloid were injected, and measurements made at 48 hr and 30 min, respectively. The information was stored and analyzed by computer. The Tc-99m image was subtracted from the gallium image using the blood pool in the heart as a reference point. The result was considered positive if the Ga:Tc activity exceeded 40% or equalled the heart activity.

Of 22 cirrhotic patients five positive subtractions were confirmed by histology. In 17 negative examinations one hepatoma was missed. In 16 patients with noncancerous cirrhosis the subtraction scintigrams were all negative. The technique works even if the hepatoma cannot be seen in the gallium image when the uptake in the lesion is equal to normal liver.

Clinical Trial of Four Pancreatic Scanning Agents. J. E. Agnew and M. Maze. *British Journal of Radiology* 51: 206–209, 1978.

The search for a better pancreas imaging agent continues. The authors assessed the clinical efficacy of four radiopharmaceuticals produced by the Radiochemical Centre: Se (2 aminoethyl) L-selenocysteine, Se methyl L selenocysteine, L selenoethionine, 2 amino-3-(3-benzo (b) selenophenyl) propionic acid. Visualization of the pancreas with all four agents was poorer than would have been expected with se-

lenomethionine. Whole body studies demonstrated a faster blood clearance of Se-75 when the new compounds were used.

Sodium Pertechnetate Tc-99m Scanning of the Abdomen. P. F. Winter. *JAMA* 237: 1352, 1977.

A 5-year-old girl with a 1-yr history of intermittent abdominal pain and chronic lower gastrointestinal bleeding was studied with sodium pertechnetate for possible Meckel's diverticulum. Anterior views at 20 and 40 min after injection of 1 mCT of sodium pertechnetate showed a focal area of increased uptake in the right midabdomen. At surgery, a duplication cyst, 3 cm^2, was found on the mesenteric side of the ileum, 22 cm from the ileocecal valve. Aberrant gastric mucosa is invariably found in patients with symptoms of ileal duplication cysts during the first decade of life. An abnormal localization of sodium pertechnetate is not specific, since it reflects only the presence of ectopic gastric mucosa.

A Scintigraphic Method of Examining the Patency of Oviducts Using ^{133}Xe. T. Pertynski, W. Jakubowski, J. Stelmachow, W. Grahan, and S. Zurowski. *European Journal of Nuclear Medicine* 2: 159–164, 1977.

A technique that reduces the radiation dose to young prospective mothers under investigation for infertility is described by this group of Polish workers. Scintigraphic pictures are obtained and analyzed following the injection of a solution of 300 μCi Xe-133 in 10 ml of saline through the external os. There was a complete correlation with the results of x-ray hysterosalpingography in 30 patients with primary or secondary infertility aged between 20 and 38. Apart from a reduction in radiation dose of about 3–4 times that used with x-ray methods, the technique offers the advantage of less pain due to the xenon solution having a lower specific gravity than the x-ray contrast medium.

Screening of a Family for Chemodectoma. J. H. J. Ruijs, P. F. G. M. van Waes, G. de Haas, A. Hoekstra, P. H. M. Mulder, and J. E. Veldman. *Radiologia Clin* 47: 114–123, 1978.

The slow-growing chemodectoma (glomus caroticum tumor) often causes serious local destruction to the bone of the cranium, and the tumor may show an increased frequency of occurence within individual families. Fifty-nine members of a family were screened after the case history of a male patient with chemodectoma revealed that two of his daughters also had a verified glomus caroticum tumor, and that three brothers had a facial paralysis of unknown cause. Each person received 20 mCi Tc-99m methylene diphosphonate (MDP). A perfusion study and bone scintigraphy were obtained after the injection. The nuclide screening process was performed with two gamma cameras: one for the region of the skull base, neck and upper thorax, and one for the abdomen and the pelvic region. The study was viewed on persistence oscilloscopes while TV-cameras recorded the examination, and the data was then stored on video recording equipment. Patients with positive scintigrams were referred for radiologic verification. Angiography was carried out in eight of ten persons who had a positive scintiphoto after prior administration of propanolol to prevent catecholamine liberation from the tumor. Radionuclide angiography showed six positive and four questionable findings. The angiographic examinations verified the presence of chemodectoma in all instances of positive angioscintigraphy. Three of the four questionable scintigraphic findings were found to be associated with atypical vascular formations: kinking, hypertrophy, and tortuosity. Three glomus caroticum tumor carriers, previously unidentified, were found during the study. The authors conclude that all family members of patients afflicted with chemodectoma be screened for the tumor with angioscintigraphy and bone scans.

A Comparison of ^{99m}Tc and ^{123}I Scintigraphy in Nodular Thyroid Disorders. H. Dige-Petersen, S. Kroon, S. Vadstrup, M.-L. Andersen, and N. O. Roy-Poulsen. *Eur J Nucl Med* 3: 1–4, 1978.

The authors compared the thyroid scans obtained with pertechnetate and with I-123. Eighty-three consecutive patients with nodular goiter were included in the study. The pertechnetate scintigraphy was performed 20 min after i.v. application of 4–5 mCi of the tracer. A minimum of 100,000 counts were gathered using a camera with pinhole collimator positioned 12 cm from the neck of the patient. A minicomputer and color TV were used to process and display the scintigraphic results. The I-123 scintigraphy was carried out 2 to 21 days after the pertechnetate study. The studies were obtained 60 min after injection of 0.5 mCi of the nuclide. With collection of a minimum of 50,000 counts I-124 contamination did not exceed 2%. The two sets of scintigrams were compared with a digital color display with eight color levels, each representing 12.5% of the maximum activity per unit area. A regional difference in activity was presumed when a well-defined area had a 25% difference in counts between the two examinations. Scintigraphic results were similar in 70 of the 83 patients. Reduced I-123 incorporation was seen in eight patients: four times in simple multinodular goiter, twice in tryoiditis, and once each in autonomous adenoma and in toxic multinodular goiter after therapy. Low pertechnetate activity was observed in five instances of nodular goiter, one of which was hyperthyroid. The results of the study correspond to previously published data for patients with nodular thyroid disorder. Differences in the distribution of the two radiopharmaceuticals seem to indicate focal differences in organic binding of radioiodine relative to the trapping of iodine or pertechnetate. The present study shows that these differences are already observable 1 hour after iodide administration, and demonstrates once more that discrepant results are relatively common.

Trapping and Re-use System for Radioactive Xenon in Nuclear Medicine. M. Bolmsjo and B. Persson. *Phys Med Biol* Vol. 23, No. 1: 77–89, 1978.

This paper reviews different methods of trapping radioactive xenon—e.g., adsorption onto activated charcoal at room temperature, refrigerated charcoal adsorption, cryogenic distillation, solution in fluorocarbon, and separation by permselective membranes. Of these, the activated charcoal method has the advantage of being simple and cheap and also allows for recycling of the xenon. The authors describe an activated charcoal trapping system that can extract Xe-133 from 100 ml of expired air in 10 min. The trapped gas can be rapidly released and returned to a spirometer. Recycling Xe-133 results in a substantial reduction of costs.

An Improved Uptake Probe Designed for a Large Crystal Rectilinear Scanner. L. Clarke, G. Duffy, and J. Maline. *Phys Med Biol* Vol. 23, No. 1: 118–126, 1978.

The authors describe a focused collimator designed for use with NaI(Tl) crystals for quantitative organ uptake

measurements in vivo. The drawbacks of conventional uptake probe designs include a nonuniform response volume along the detector axis and a large diverging field of view. Hence the sensitivity is strongly dependent on organ depth and on the amount of activity in the surrounding tissues. Isoresponse curves show the new design to give an improved response relative to organ depth and a reduction in the effect of the surrounding activity. Phantom measurements suggest that under suitable circumstances the probe could be used to measure absolute organ activity.

Study on New Adrenal Scinti-Scanning Agent (Comparison of 6-Iodomethyl-19-nor-cholest-5(10)-en-3-ol-^{125}I and 19-Iodocholesterol-^{125}I). F. Umeda, K. Kato, H. Ibayashi, M. Maeda, and M. Kojima. *Jap J Nucl Med* : 335–340, 1977.

Two pure adrenal scanning agents, 6β-iodomethyl-19-norcholest-5(10)-en-3β-ol-^{125}I (NCL-6-^{125}I) and 19-iodocholest-5(6)-en-3β-ol-^{125}I (CL-19-^{125}I), were synthesized and administered to dogs. These two agents were compared with respect to adrenal accumulation and the concentration ratio of adrenal gland to liver. NCL-6-^{125}I accumulated 2.2 times greater than CL-19-^{125}I in the adrenal gland, and the adrenal/liver ratio of NCL-6-^{125}I was 2.9 times higher than that of CL-19-^{125}I. These results indicated that a NCL-6-I was more useful adrenal scanning agent than a CL-19-I. Thin layer chromatographic studies of the metabolic pattern of these two agents in the adrenal gland demonstrated that CL-19-^{125}I was esterified in about 41%, and it was suggested that CL-19-^{125}I was converted to adrenocorticosteroids. On the other hand, esterification of NCL-6-^{125}I was much smaller (3.6%), 27.1% of the radioactivity remained at the NCL-6-I position on the thin layer chromatogram, suggesting that NCL-6-^{125}I was not converted to steroids. NCL-6-^{131}I proved to be useful for the diagnosis of adrenal cancer and its metastasis.

^{99m}Tc-(Sn)-Pyridoxylidenevaline and ^{99m}Tc-(Sn)-Pyridoxylideneisoleucine: Potential Radiopharmaceuticals for Hepatobiliary Tract Imaging. M. Kato and M. Hazue. *Jap J Nucl Med* 14: 927–931, 1977.

Pyridoxal hydrochloride (3,665 mg, 18.0 mM), L-(+)-ascorbic acid (as the stabilizer, 70 mg, 0.4 mM) and anhydrous stannous chloride (15.2 mg, 0.08 mM) were dissolved successively in 100 ml of sterile, apyrogenic and oxygen-free (deoxygenized by nitrogen gas bubbling) water (solution A). In another vessel, sodium hydroxide (1,440 mg, 36.0 mM) and L-valine (2,109 mg, 18.0 mM) or L-isoleucine (2,361 mg, 18.0 mM) were dissolved in 100 ml of sterile, apyrogenic and oxygen-free water (solution B). While stirring, solution B was poured into solution A. Finally, 2.2 ml of the resultant bright-yellow solution was dispensed through a 0.22 μm Millipore filter into sterile 3 ml ampules and each ampule flame sealed. All of the above processes were carried out under a nitrogen atmosphere. This Sn-PVal kit reagent (pH 8.52) and Sn-PIle kit reagent (pH 8.55) were stored at 4°C until used. The analysis of ^{99m}Tc-(Sn)-PVal and ^{99m}Tc-(Sn)-PIle by thin-layer chromatography showed that the labeling efficiency of the kit reagents was practically 100%. Both of these Tc-99m-labeled complexes had an Rf value of 0.78–0.85 and demonstrated a sharp single peak on the scanning chromatogram. With this chromatographic system, $^{99m}TcO_4^-$ had an Rf value of 0.95–0.98, and both ^{99m}Tc-pyridoxal and ^{99m}Tc-Sn colloid remained at the origin. The in vivo tissue distribution of the radioactivity indicated that these Tc-99m-labeled complexes were very rapidly cleared from the blood by the liver and excreted into the small intestine. No change in the chromatographic results or the in vivo behavior of the kit reagents was observed after storage for 60 days and the complexes were stable for 48 hr after Tc-99m-labeling.

Intracellular Dynamic State of Tumor-philic Radionuclides. Continuous Cell Fractionation with Rate-isopycnic Zonal Centrifugation. K. Samezima, Y. Sasaki, A. Yamaguchi, and H. Orii. *Jap J Nucl Med* 14: 485–491, 1977.

In an attempt to improve certain disadvantages of conventional cell-fractionation methods with differential pelleting, the authors carried out rate-isopycnic zonal centrifugation to fractionate the subcellular particles of rat liver in an Anderson-type zonal rotor with sucrose density gradient. The results indicated improved separation of lysosomes from perosixomes, as well as cell nuclei, mitochondria and cell supernatent. The authors' method yielded fractions that included all subcellular components, especially cell nuclei, which by Anderson's method were discarded. The results suggest the possibility of precisely measuring the intracellular dynamics of various radionuclides that demonstrate tumor affinity. This basic study is to be followed by evaluations of various tumor-philic radionuclides.

Radionuclide Axial Tomography by Half Back-Projection. J. Isenberg and W. Simon. *Phys Med Biol* Vol 23, No. 1: 154–158, 1978.

A modified, filtered, back-projection algorithm is described in which each projection of recorded data is allowed to contribute to only one-half of the reconstructed image. Using a clock analogy the rationale assumes that projections recorded on one side of a thick object contain little information about the activity distribution on the opposite side. Images of an acrylic phantom, with ellipsoid activity wells of different diameters, show the half back-projection method to give improved image quality near the perimeter as compared to full back-projection. Little improvement is noted toward the center, as would be expected, since the information retained there is of about the same quality as that which is discarded.

Transverse Tomography with Incoherent Optical Reconstruction. P. Edholm, L. Gosta Hellstrom, and B. Jacobson. *Phys Med Biol* Vol. 23 No. 1: 90–99, 1978.

The authors describe the reconstruction of tomographic images from sinograms, which are produced by an x-ray fan beam rotating around an object while a recording film in a direction perpendicular to the plane of the fan beam. The sinogram image is convoluted according to a special function before reconstruction to remove artifacts. The reconstruction is accomplished from the convoluted sinogram by means of a back projector, which operates according to a principle that is the reverse of the recording technique. Tomograms of phantoms, pork chops, and the head of a dog show the process to be capable of high spatial resolution, but it is limited by low contrast.

Ultrasound Evaluation of the Nonvisualized Gallbladder. F. Azimi, J. P. Marangola, and P. J. Bryan. *Gastrointest Radiol* 1: 293–299, 1977.

The authors review the recent literature with respect to ultrasonography of the gallbladder and biliary tract and present a number of illustrative cases in which ultrasonography provided a definitive diagnosis not available by radiographic means. Since the method does not depend upon function, cholelithiasis can be identified in the gallbladder, which is not visualized with oral cholecystography. In the presence of jaundice, both oral cholecystography and i.v.

cholangiography have been bypassed, and the anatomic etiology defined by ultrasound. Surgical or obstructive jaundice can be differentiated from medical or nonobstructive states; distention of the gallbladder and intrahepatic biliary radicles can be identified; and frequently neoplasm in the head of the pancreas, porta hepatis, or Ampulla of Vater can be seen. Absence of obstructive signs in the jaundiced patient weighs heavily in favor of entities such as hepatitis and contributes significantly to the management of the patient. The authors feel that ultrasonography is the diagnostic modality of choice for further investigation of a gallbladder that is not visualized by oral cholecystography, and for the examination of the biliary system in the jaundiced patient who cannot be studied by oral cholecystography or i.v. cholangiography.

Gallstones Preventing Ultrasonographic Visualization of the Gallbladder. F. C. Laing, G. A. W. Gooding, and K. A. Herzog. *Gastrointest Radiol* 1: 301–303, 1977.

The authors present eight cases in which the diagnosis of cholelithiasis was made by ultrasound, despite the fact that the gallbladder was not visualized. When the gallbladder lumen is completely filled with multiple small stones, or, as in one case presented here, a single large stone, the bile-filled leumen and outline of the gallbladder are not visualized. A reproducible dense collection of echoes in the expected region of the gallbladder, however, produces a sonic shadow strongly indicative of cholelithiasis. Such demonstration requires a single sweep technique. Gas in the hepatic flexure of the colon producing a shadowing in the right upper quadrant can be differentiated from cholelithiasis by virtue of the more gradual discontinuation of the echoes with gas and the absence of the strong superficial echoes produced by the stones.

Antenatal Diagnosis of Hydranencephaly by Ultrasound: Correlation with Ventriculography and Computed Tomography. T. G. Lee and B. H. Warren. *J Clin Ultrasound* 5: 271–273, 1977.

Hydranencephaly is another fetal anomaly that can be added to the existing spectrum of anomalies detected in utero by ultrasonography. The authors present a case in which the findings included a large head, as compared with the diameter of the fetal body, and almost complete filling of the cranial vault by fluid. Portions of the falx were visualized, but the structure was believed to be incomplete. The posterior fossa contents were readily identified, and the antepartum diagnosis of hydranencephaly made. Neonatal plain film and computed tomography studies confirmed the diagnosis and showed the precise nature of the cranial contents. The clear delineation of the fluid-filled cranial vault with recognition of the posterior fossa contents should serve to differentiate this entity from simple hydrocephalus. Obstetrical management was greatly facilitated by the ultrasonographic findings.

Atypical Cholesonograms in Primary and Secondary Malignant Disease of the Biliary Tract. J. J. Cunningham. *J Clin Ultrasound* 5: 264–267, 1977.

The author describes five cases in which an abnormal ultrasonographic appearance of the gallbladder was produced by malignant disease in or about the gallbladder. Metastatic adenocarcinoma and squamous cell carcinoma about the mesentery and in the region of the porta hepatis produced extrahepatic biliary obstruction. In one case lymphomatous obstruction of the common bile duct accompanied the "incidental" demonstration of multiple calculi in the biliary tree. Sloughed necrotic tumor cells from a malignant melanoma produced atypical internal echoes within an enlarged gallbladder, in part simulating calculi but displaying an obviously atypical pattern. The inference from the case presentations is that such atypical cholesonograms should alert the observer to consider malignant disease in or about the biliary tract other than the relatively commonly encountered carcinoma of the head of the pancreas or Ampulla of Vater.

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