ABSTRACTS OF CURRENT LITERATURE

External Cancer Detection with Radioantibodies to Carcinoembryonic Antigen. D. M. Goldenberg, F. H. DeLand, E. E. Kim, S. Bennett, F. J. Primus, J. R. van Nagell, Jr., N. Estes, P. DeSimone, and P. Rayburn. *New Engl J Med* 298: 1384–1388, 1978.

Radioantibody tumor localization by scintillation scanning is reported utilizing I-131-labeled anticarcinoembryonic antigen injected intravenously in a series of 18 patients with malignancy. Scans were performed 4, 8, 24, and 48 hr after injection of the radioantibody. Interference from blood-pool activity and from free iodine activity in the stomach and urinary bladder was computer-subtracted by means of data obtained from scans performed following the injection of $^{99m}TcO_4^-$ and Tc-99m-labeled human serum albumin before and after radioantibody imaging. All positive and negative radioantibody scan findings were compared to results obtained by other diagnostic procedures. Types of malignancies studied included carcinomas originating in the uterine cervix, ovary, colon, rectum, breast, bronchus, endometrium, common duct, and one case of lymphoma. No localization of radioantibody was seen in the lymphoma. All primary and secondary sites were correctly identified in the other tumor types with the exception of one intracerebral metastasis from lung carcinoma and one metastatic skull lesion in breast carcinoma. Endogenous carcinoembryonic antigen (plasma levels from 0.2 to 350 mg/ml) did not prevent radioantibody tumor localization. The authors conclude that carcinoembryonic antigen radioantibodies appear to be a useful adjunct for the detection and localization of recurrent carcinomas.

Dynamic Radionuclide Phlebography. A Clinical Study in Patients after Total Hip Replacement. A. S. Nillius, R. Lindvall, and G. Nylander. *Eur J Nucl Med* 3: 161–167, 1978.

The authors sought to compare radionuclide phlebography and contrast phlebography in 34 patients examined for iliofemoral thrombosis from Day 10 to 14, after total hip arthroplasty. A scintillation camera with a low-energy diverging collimator interfaced to a minicomputer was used in the nuclear medicine procedure. For pelvic vein imaging, 1.5 mCi Tc-99m albumin macroaggregates were used and 0.5 mCi of the technetium tracer for femoral vein evaluation. To promote radionuclide distribution to the deep venous system a blood pressure cuff was placed above the malleolus and inflated to 50 mm Hg. Regions of interest (ROI) equidistant from the injection sites were selected over both iliac veins and were also selected over the saphenous and the superficial femoral vein when these were prominent in the study. A time-activity curve was generated for each ROI, and the mean transit time (MTT) was calculated. The authors found that normal radionuclide phlebograms had a steep rise and a smooth exponentially falling curve segment, with a MTT of 35 sec. Total occlusion of the superficial femoral vein with collateral passage through the saphenous vein resulted in a spike-like curve and a short MTT of 9 sec. Partial thrombosis of the superficial femoral vein resulted in a curve with two peaks, although the MTT was not significantly different from normal findings. Extensive deep-vein thrombosis resulted in a MTT of 15 sec, which was statistically significant when compared with normals. Deep vein thrombosis (DVT) of the lower leg was not identified on the basis of MTT. The authors conclude that MTT determinations will identify only extensive DVT. Major redistribution of particle flow to superficial veins, however, was identified in 80% of the ileofemoral thrombi recognized by contrast phlebography.

New Technique for Localization of Therapeutic Emboli Using Radionuclide Labeling. R. M. Conroy, K. P. Lyons, J. H. Kuperus, G. L. Juler, I. Joy, and H. F. W. Pribram. *Am J Roentgenology* 130: 523–528, 1978.

Absorbable gelatin sponge labeled with Tc-99m was injected by means of a catheter into vessels selected for therapeutic embolization. The radionuclide label permitted monitoring of the progress of each labeled particle using the persistence scope of a portable gamma camera stationed in the angiography suite. Documentation of the resting site of the emboli was obtained by means of Polaroid film. Labeling and monitoring of the injected embolic material make the procedure considerably safer and reduce the chance of obstructing blood vessels other than those intended.

Two-Dimensional Real-Time Ultrasonic Imaging of the Heart and Great Vessels. A. J. Tajik, J. B. Seward, D. J. Hagler, D. D. Mair, and J. T. Lie. *Mayo Clinic Proceedings* 53: 271–303, 1978.

Real-time, wide-angle, two-dimensional echocardiography yields anatomic and functional information not available with either M-mode echocardiography or angiographic techniques. This new and exciting diagnositc modality presents the cardiac structures in an unfamiliar format. Utilizing phased-assay electronic sector scanning and four basic transducer positions (parasternal, apical, subxiphoid, and suprasternal notch), the authors outline the anatomy of the heart and great vessels as seen in 20 tomographic "slices." The findings presented are based on a detailed analysis of 500 such examinations and are validated by anatomic and two-dimensional contrast echocardiographic studies. A unified concept of image orientation is presented to simplify the presentation of the various long-axis and short-axis views. Technical detail of transducer positions, angulations, and modifications necessary to obtain the desired tomographic sections are discussed along with the particular application of each of these views in the diagnosis of abnormalities of cardiac structure and function.

Radioimmunoassay for Human Myoglobin—Initial Experience in Patients with Coronary Heart Disease. M. Reichlin, J. P. Visco, and F. J. Klocke. *Circulation* 57: 52–56, 1978.

In this study, horse myoglobin (which cross-reacts significantly with an antihuman myoglobin serum) was radioiodinated using chloramine-T reagent that had failed to yield successful incorporation of I-131 in human myoglobin (Mb). The clinical radioimmunoassay (RIA) described involved incubation of 0.1 ml patient serum (and separate dilutions thereof) with I-131 horse-myoglobin and rabbit antiserum to Mb for 24 hr at 4C. Bound antigen was then separated from free by sheep antirabbit gamma globulin and the resulting precipitates were counted in a scintillation spectrometer. RIA sensitivity was 0.35 ng Mb or a biologic fluid concentration of 2 ng/ml. Peak serum Mb in 13 normal individuals measured 25 ± 23 (SD) ng/ml (Range 3–75). Peak Mb in 32 patients with acute myocardial infarction established by clinical and laboratory criteria (not includ-

ing myocardial scintigraphy) was 1367 ± 1357 ng/ml (range 200–5500). Eight of 19 patients who presented with chest pain clinically regarded to be cardiac in origin but who showed no later laboratory evidence of myocardial necrosis had peak Mb of 162± 52 ng/ml (range 102–280). In the remaining 11 subjects, Mb was 38 ± 16 ng/ml (range 15–75). All of the 17 subjects whose chest pain was not diagnosed clinically or by laboratory criteria to be of cardiac origin had peak Mb in the normal range. In yet other patients, elevations in Mb occurred following grand mal seizures, trauma, and cardiopulmonary resuscitation. Elevations in Mb originating from skeletal muscle undoubtedly will complicate evaluation of cardiac problems, since cardiac and skeletal muscle Mb are immunologically identical, thereby presenting a limitation on the diagnostic specificity of this RIA.

Creatine Kinase BB Isoenzyme Levels by Radioimmunoassay in Patients with Neurological Disease. R. D. Bell, R. N. Rosenberg, R. Ting, A. Mukherjee, M. J. Stone, and J. T. Willerson. *Ann Neurol* 3: 52–59, 1978.

Creatine kinase BB isoenzyme (CK-BB) exists in brain tissue. In this study, an existing double-antibody radioimmunoassay (RIA) was used to quantitate CK-BB in cerebrospinal fluid (CSF) and in serum from 61 patients with neurologic disease. RIA reagent preparation involved the following: CK-BB was isolated from human brain tissue at postmortem examination and labeled with I-125. Antiserum was prepared in rabbits. The RIA procedure required 20 μl CSF or esrum (10 μl for repeat on elevated values) and required 3 days to complete. Test sensitivity is 0.2 ng. Normal CSF and serum values were 7.5 ± 2.2 (mean ± SEM) ng/ml (range 0–12.1) and 2.9 ± 3.0 ng/ml (range <1.0–12.5), respectively. Significant increase in CK-BB levels were noted in the CSF of patients who had had acute cerebrovascular accident that occurred within 5 days of the lumbar puncture. Significant elevation of isoenzyme was noted in sera of patients with acute cerebrovascular accident and in those who had seizures with prolonged alteration of consciousness (over 6 hr). No elevation in isoenzyme level in either biologic fluid was found in demented patients, or in patients with amyotrophic lateral sclerosis, myasthenia gravis, postconcussion syndrome (6 mo following injury), or lupus erythematosis. The authors suggest that further work is needed to determine if CK-BB elevation, which is felt to reflect actual tissue damage in patients with head trauma and cerebrovascular accident, is quantitatively related to the degree of brain damage.

Progress in Gastroenterology: Radioimmunoassay of Gastrointestinal Hormones. E. Straus. *Gastroenterol* 74: 141–152, 1978.

The author reviews the clinical status of gastrointestinal peptide hormones [gastrin, secretin, and cholecystokinin (CCK)] along with methodologies for their quantitation in biologic samples. Work with gastrin, the most widely studied hormone, provides insight into the nature of acid-peptic disease. Plasma gastrin radioimmunoassay (RIA) has proven of value in the diagnosis of gastrin-secreting tumors (Zollinger-Ellison syndrome). Recent assay improvements have permitted measurement of plasma gastrin down to 2.5 pg/ml. Investigations on secretin and CCK have been sparse because of the lack of clearly-defined clinical problems. Nevertheless, recently-designed RIA's have been used to evaluate the distribution of secretin and CCK in the gastrointestinal mucosa, the fate of these hormones after parenteral administration, and the effect of ingesting or artificially infusing the gastrointestinal tract with various substances on circulating hormonal concentrations. The author elaborates on the technical problems encountered in the RIA of gastrointestinal hormones. Some of these are: a) the low concentration in plasma of certain of these hormones in the unstimulated state (i.e., when not being secreted to aid in digesion of food) requires the utmost of assay sensitivity; b) antisera and labeled peptide chosen for assay have often later been proven to yield assay sensitivity inadequate for the desired clinical purpose; c) gastric juice, because of its low pH, must be neutralized before RIA testing to prevent reagent inactivation; and d) the high proteolytic enzyme content of gastric and duodenal juices can destroy labeled antigen or specific antibody reagents if the enzymes are not first inactivated by heat. The author mentions finally the RIA's for other peptides isolated from gastrointestinal mucosal tissues: gastric inhibitory polypeptide (GIP), vasoactive intestinal polypeptide (VIP), motilin, and pancreatic polypeptide. The gastrointestinal mucosa may be an extremely productive endocrine organ.

Quantitation of Gastroesophageal Reflux before and after Therapy Using the Gastroesophageal Scintiscan. L. S. Malmud and R. S. Fischer. *Southern Med J* 71: 10–15, 1978 (Suppl 1).

A gastroesophageal scintiscan was performed in 30 fasting patients who had symptomatic heartburn and a positive acid reflux test and in 20 control subjects without symptoms of gastrointestinal disease. A double lumen tube assembly with an isotopic marker on the tube midway between two pressure recording orifices 10 cm apart was positioned at the lower esophageal sphincter, by measuring the intralumenal pressure. Then 300 ml of isotonic saline containing 100–300 μCi Tc-99m sulfur colloid were instilled into the tube and 30-sec-timed images were obtained from the gamma camera above the patient in supine position. Pressures were measured in the esophagus and stomach simultaneously, as the pressure gradient across the lower esophageal sphincter was increased in increments of 5 mm Hg from 10 to 35 mm Hg by inflating an external abdominal binder. Stored data from the gamma camera were processed later using a data analyzer, and the gastroesophageal reflux was compunted using the formula. Visible gastroesophageal reflux was detected in 27 of 30 symptomatic patients (90% sensitivity) and the scintiscan proved to be more sensitive to detect the reflux than any other diagnostic technique. The mean reflux index for the test patients was 11.7 ± 1.8%, compared to 2.7 ± 0.3% for the controls ($p < 0.001$). Using quantitative criteria, the upper limit for reflux in normal subjects was 4%. This study suggests that the gastroesophageal scintiscan has the ability to quantitate the reflux and is valuable for investigation of the mechanism of reflux.

Quantitative Sacroiliac Scintigraphy in Patients with Crohn's Disease. P. Davis, A. B. R. Thomson, and B. C. Lentle. *Arthritis Rheum* 21: 234–237, 1978.

Sixty patients with Crohn's disease were examined for sacroilitis using quantitative sacroiliac scintigrams obtained by profile scanning following an injection of Tc-99m-labeled stannous pyrophosphate. Presumptive evidence of sacroilitis (uptake ratio of sacroiliac joint to central sacrum of greater than 1.3:1) was found in 31 patients. Six of these patients with abnormal SI:S ratios had radiologic changes of sacroilitis. The tissue antigen HLA-B27 did not occur with significantly increased frequency in this series of patients, and there was no correlation of HAL-B27 with the presence of

sacroilitis. The authors believe that inflammatory disease of the sacroiliac joints occurs much more frequently in Crohn's disease than was previously supposed. They emphasize that the radiologic changes of sacroilitis are seen only in advanced disease and that the bone scan may be a more sensitive indicator of active sacroiliac disease.

The Influence of Serum Folate on Urinary Excretion of Vitamin B_{12}. E. Van Royen, P. Blockx, and F. Molter. *Eur J Nucl Med* 3: 175–178, 1978.

A normal or increased excretion of labeled vitamin B_{12} has been reported in some instances of pernicious anemia, where reduced loss would be expected. The authors sought to explain these findings using the Schilling test, as modified by Katz, in 110 fasting patients, each of whom was given an oral tracer dose of 0.8 μCi Co-58 vitamin B_{12} and 0.5 μCi Co-57 vitamin B_{12}-IF (intrinsic factor) complex. Labeled vitamin B_{12} was flushed from the blood with an IM injection of 1 mg cyanocobalamin. Forty-eight-hour urine collection, in 12-hour fractions, followed. The percentage of each tracer dose in the urine was determined, and the ratio of Co-57 to Co-58 was calculated (Dicopac ratio). A fasting blood sample drawn before the examination, and once weekly thereafter, was examined for folate, gastrin, and vitamin B_{12} concentrations. Fourteen patients were excluded from the study because of: incomplete urine collection in eight, Crohn's disease in three, and premature folate therapy in three. Seven patients were reexamined 1 mo after folate therapy. The authors found Co-57 excretion dependent upon serum folate levels. Patients with serum folate levels under 4.5 ng/ml had a mean Co-57 excretion of 20.4% $\pm$ 8.9%, and those with a serum folate level greater than 4.5 ng/ml had a mean Co-57 excretion of 13.4% $\pm$ 5.7% ($\pm$1 SD). Cobalt-58 demonstrated a similar folate dependent excretory pattern. Patients with serum folates less than 4.0 ng/ml had a mean Co-58 excretion of 19.2% $\pm$ 9.1% and those with levels equal or greater than 4.0 ng/ml had a loss of 10.6% $\pm$ 6.7% ($\pm$1 SD). Those with increased fasting serum gastrin and serum folate values $\geq$3.5 ng/ml had pathologic Dicopac ratios. Cobalt-57 and Co-58 excretion ratios did not correlate with increased serum gastrin when serum folate was less than 2.5 ng/ml. Seven patients reexamined after 1 mo of folate therapy showed decreased Co-57 and Co-58 excretion, compared with the first examination. The authors feel that B_{12} excretion is closely linked to serum folate levels. Decreased serum folate levels can result in increased B_{12} excretion. When this occurs in patients with pernicious anemia, it can lead to false normal Schilling test results. Folate deficiency can lead to atrophic intestinal mucosal cells and increased permeability of the intestine for both vitamin B_{12} and intrinsic factor-vitamin B_{12} complex. The authors feel that B_{12} that has diffused through an atrophic intestinal wall may not bind to serum proteins and may then show accelerated excretion.

Correlation between Liver Scintigraphy and Computed Tomography in the Detetcion of Liver Metastases. J. Frühling and M. Osteaux. *Eur J Nucl Med* 3: 169–174, 1978.

The authors sought to compare radionuclide scintigraphy and CT scans of the liver in patients with histologically verified malignant disease. Fifty-five patients were studied, 23 after i.v. nijection of 150 μCi Au-198 colloid, and 32 after injection of 1.5–2.5 mCi Tc-99m of sulfur colloid. Scintiscans were made with a rectilinear scanner (anterior and right lateral views) or with a gamma camera equipped with high-resolution parallel-hole collimator. For computed tomography a standard commercial instrument was used that required 250 sec for a cross-sectional image representing two 1.3-cm contiguous slices. The entire hepatic region was examined before and after contrast enhancement. Each study was evaluated without knowledge of the results of the other examination. The liver status was macroscopically and histologically verified for every patient at autopsy (12), surgary (22), or with peritoneoscopy with multiple liver biopsies (21). Neoplastic involvement of the liver was present in 17 patients. The authors report that scintigraphy and CT scans showed the same results in 45 patients. In 26 patients both studies were correctly negative and in 14 of 19 patients both studies were correctly positive. False-positive diagnoses were made with both studies in steatosis and four false-positive findings on both scintigraphy and CT could not be explained. In ten cases divergent results were found. In six of these, radionuclide scintigraphy was positive, whereas the CT-scan was negative. Twice the scintigraphic study was correct, and in four cases the negaitve CT scan result was verified. Negative scintiscans were contradicted by a positive CT-scan in four cases, and the results of scintigraphy were verified in three. The authors conclude that both methods are equally efficient in the detection of liver metastases and that the results are only partly complementary.

Experimental Subcapsular Hematoma of Spleen—Natural History and Radioisotope Scan Correlation. M. E. Washburn, M. W. Balk, B. A. Mazat, and J. A. Zurlo. *Ann Surg* 187: 407–410, 1978.

An experimental model was developed in dogs to correlate radioisotope scan findings of iatrogenic splenic injury with the natural history of the injury as determined by the clinical course and both gross and microscopic examinations. The spleens of eight dogs (15–20 kg) were injured using a rubber hammer to produce subcapsular hematomas (2–4 cm in diameter), and several dogs had multiple hematomas. Two dogs were used as controls. The spleen was imaged with 1 mCi Tc-99m sulfur colloid in anterior, posterior, right and left lateral, right and left anterior, and posterior oblique projections at 24 hr and 5 days posttrauma. Large subcapsular hematomas (>3 cm) appeared as distinct focal defects on scan within 48 hr postinjury. By 9 days posttrauma the focal defect disappeared, however, and an increase in size and increase in uptake of radiocolloid was evident. Small subcapsular (2–3 cm) hematomas did not show as a distinct focal defects on scans, but there were again increased concentrations of radiocolloid in the spleens and increased rates of clearance of the colloid from the blood. The authors suggest that the entity of delayed rupture of the spleen in humans is, in fact, delayed diagnosis and not delayed bleeding, since no dog developed delayed rupture, bleeding, or cyst formation by the subcapsular injury.

Ultrasonography in the Management of Unexplained Renal Failure. M. Winston, J. Pritchard, and P. Paulin. *J Clin Ultrasound* 6: 23–27, 1978.

The authors present seven cases to illustrate the value of ultrasonography in determining the basis for renal failure in those patients whose kidneys are visualized poorly or absent at i.v. urography. Examples included such entities as "small smooth" kidneys—otherwise morphologically normal which proved to represent glomerulonephritis—unexpected hydronephrosis documented in several cases, and adult polycystic disease, previously undiagnosed. The technique was

also of value to exclude clinically suspected obstruction. The value of this finding is the avoidance of unnecessary ureteral catheterization.

The Dynamic Uterus Revealed by Time-Lapse Echography. B. Buttery and G. Davison. *J Clin Ultrasound* 6: 19–22, 1978.

Sequential ultrasonic scans of the uterus of four pregnant patients, obtained at intervals from 30 sec to 10 min, showed striking dynamic changes. Gain settings and planes of the scans were not altered throughout the sequences. The position of the placenta relative to the uterus was observed to change rather markedly. On an initial scan transient thickening of the posterior uterine wall was interpreted as a submucosal fibroid, but on a scan performed approximately 30 sec later the thickening was absent. An impression of a posterior uterine wall septum also disappeared on a subsequent study. The authors feel that normal physiologic contractions of the uterus during pregnancy were responsible for these dynamic artifacts and caution that the appearances may simulate abnormalities of both uterus and placenta. Because of the slow and rhythmic nature of the contractions, neither sector nor real-time scanning is likely to detect these features. By maintaining constancy of patient position, machine calibration, and scanning plane, sequential gray-scale studies were most effective in demonstrating such dynamic changes.

The Ultrasonic Demonstration of Gastric Lesions. V. J. Mascatello, G. F. Carrera, R. L. Telle, M. Berger, H. H. Holm, and E. H. Smith. *J Clin Ultrasound* 5: 383–387, 1977.

In a series of 15 patients with circumferential gastric antral disease, ultrasonic studies were characteristic in 93%. On the longitudinal scans an ovoid anechoic area was observed posterior to the dorsal border of the liver, and this area contained a region of dense central echoes. Similar findings that corresponded to this region were found in the transverse plane as well. The authors propose that the anechoic region represents thickening of the gastric antral wall secondary to a variety of disease processes such as gastric carcinoma, lymphoma, metastatic disease, and inflammation. The dense central echoes were felt to represent the gas-filled gastric lumen. In a study of 50 patients without known gastrointestinal disease, this "ring-sign" was found in only one patient, representing the single false-positive scan. In addition to the identification of a pathologic process in the region of the gastric antrum, ultrasonography provides a noninvasive method of monitoring therapeutic response during the followup period. Percutaneous biopsy may be accomplished under ultrasonographic guidance as well.

Ultrasonography in Tumors Arising from the Spine and Bony Pelvis. L. A. deSantos and H. M. Goldstein. *Am J Roentgenol* 129: 1061–1064, 1977.

Four patients are presented in whom ultrasonography proved helpful in the evaluation of the soft-tissue components of bony tumors. The soft tissue components in two patients with giant cell tumors, and one each with Ewing's sarcoma and a sacrococcygeal teratoma, were examined. The ultrasonographic technique proved of value in defining all dimensions of the soft tissue mass allowing proper planning of radiotherapy portals and depth dose calculations. The relationships of the tumor mass to adjacent viscera can be established with this procedure and results of therapy can be assessed sequentially on followup studies.

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ERRATUM

In the article entitled "Collimator Evaluation for Tl-201 Myocardial Imaging," by H. Nishiyama et al., appearing in *J Nucl Med* 19: 1067-1073, 1978, the second sentence in the legend to Fig. 4 should read as follows: "Defect is seen on lower portion of lateral wall just above apex in PHC image in anterior view (lower row)." A corrected Table 2 in the same article is printed below.

TABLE 2. DETECTION RATE (%) OF MEDIUM-SIZED LESION

	HRC		CONV		PHC	
Distance	5 cm	10 cm	5 cm	10 cm	5 cm	10 cm
Endocardium						
ANT	89	44	33	11	89	89
LAT	100	100	78	44	100	100
Epicardium						
ANT	100	100	100	100	100	100
LAT	100	100	100	100	100	100