ABSTRACTS OF CURRENT LITERATURE

Skeletal Scintigraphy In The Initial Assessment Of Women With Breast Cancer. A. Lindholm, L. Lundell, B. Mårtenson, and A. Thulin; Jönköping, Sweden. *Acta Chir Scand* 145: 65–71, 1979

The authors retrospectively analyzed results of initial bone scintigrams obtained in patients with breast cancer. Four hundred sixty-seven women were included in the study, 75% of whom were postmenopausal. Patients were classified clinically with the TNM system. Three hours after injection of either 10 mCi Tc-99m PP_x or Tc-99m diphosphonate gamma camera scintiscans were made of the spine, ribs, breast bone, and pelvis, and the results classified as positive, negative, or suspicious. Follow-up radiograms were used to evaluate positive and equivocal scans. Scintigrams with pathological radiotracer uptake were considered false positive when radiographs identified benign skeletal abnormality. The authors found positive scans in 9.8% and suspicious scans in another 9.8% of the patients. 11.2% of patients with positive scans were postmenopausal whereas only 3.5% of scans were positive in premenopausal women. Tumor location in the breast was not able to be correlated with results of scintigraphy. Positive scans were found with increasing frequency with advance of disease as indicated by TMN staging. A close correlation was also found between tumor size and frequency of positive scintigrams. Histologic evaluation of the degree of malignancy, carried out in 414 patients, was related to frequency of positive scans. The authors suggest that bone scintigraphy can aid in staging and thus help in determining prognosis of breast carcinoma.

The Value of Whole Body Bone Scan in the Pre-Operative Assessment in Carcinoma of the Breast. P. Hahn, K. J. Vikterlöf, H. Rydman, K. W. Beckman, and O. Blom; Oerebro, Sweden. *Eur J Nucl Med* 4: 207–210, 1979

Results of a prospective study in 126 patients to assess preoperative total body scintigraphy in breast cancer are reported. An electrocardiogram, a clinical, and roentgenographic examination were done in each patient. Radiograms included the thoracic and lumber spine in AP and lateral projections, an AP pelvis, and PA chest film. Cervical vertebrae and skull radiograms, tomography and hydroxyproline excretion were done as needed. One hundred patients without malignant disease served as controls. Four hours after injection of 15 mCi Tc-99m HEDP anterior and posterior images were obtained with a camera and diverging collimator. Scan rate was 10 cm/40 sec. Thirty-six patients were grouped in Stage I. Scintigraphy failed to identify bone lesions. Eleven patients had control scans at 6 mo, the scans remained negative. Sixty-two patients were classified as Stage II, two of whom were found to have positive scans. Twenty-two had repeat scans at 6 mo, with one scan turning positive. Seven of 23 Stage III patients had scintigraphic lesions suggestive of metastatic lesions. Repeat scans were done in seven patients at 6 mo, two demonstrating new lesions. Five of the six patients with bone lesions visualized in the initial scintigrams had normal radiographs, none reported pain. The authors conclude that a negative whole body scan essentially precludes radiographic evidence of metastasis, and that scintigraphy should precede surgery to aid in therapy planning.

Regional Ejection Fraction: A Quantitative Radionuclide Index of Regional Left Ventricular Performance. D. E. Maddox, J. Wynne, R. Uren, J. Anthony Parker, John Idoine, Lawrence C. Siegel, Jane M. Weill, Peter F. Cohn, B. Leonard Holman; Harvard, Cambridge, Massachusetts. *Circulation* 59: 1001–1009, 1979

Radionuclide measurements of regional left ventricular ejection fraction were evaluated as a quantitative index of regional left ventricular function. Left ventricular regional ejection fractions were derived from background-corrected, time-activity curves in 43 patients assessed by both gated-equilibrium radionuclide angiocardiography and left ventricular contrast angiography. Gated-radionuclide angiocardiograms were obtained with in vivo red blood cell labeling with pertechnetate. From a single modified left anterior oblique projection, the regional change in background-corrected counts was determined in each of three anatomic regions—anteroseptal, apical, and inferoposterior. Regional ejection fraction was compared with percentage segmental axis shortening and extent of akinetic segments in corresponding regions of the contrast ventriculograms. Average global ejection fraction for 22 patients with normal contrast ventriculograms was 65 ± 8% by radionuclide evaluation and 69 ± 7% by contrast ventriculography. Radionuclide and contrast methods were in agreement as to the presence or absence of abnormal wall motion in 83 of 99 left ventricular regions (84%) in 33 patients. Comparison of regional ejection fraction demonstrated significant differences between regions with radiography determined normokinesis (75 ± 3%), hypokinesis (44 ± 3%), and akinesis (24 ± 5%). The authors conclude that the measurement of regional ejection fraction provides a quantitative method to assess regional left ventricular wall motion, and it may also prove useful in assessing the natural progression of coronary artery disease.

Mobile Gamma Cameras and ^{99m}Tc-Labelled Phosphates in Acute Myocardial Infarction. A. V. Pereira-Prestes, R. M. Donaldson, P. J. Ell, N. J. G. Brown, P. H. Jarritt, T. Al-Baghdadi, and A. T. Elliott; London, United Kingdom. *Nucl-Med (Stuttg)* 18: 73–78, 1979

Scintigrams made after injection of MDP, IDP, and PPi were compared for demonstration of acute myocardial infarction. Two groups of 20 patients, all with suspected myocardial infarction, were scanned daily for a period of 3 to 4 days. One group was imaged on alternate days with Tc-99m IDP and Tc-99m MDP. The second group was scanned alternately with Tc-99m MDP and Tc-99m PPi. Images each containing 400,000 cts were obtained in anterior, LAO, and left lateral projections after injection of 8 mCi tracer. Images were evaluated by experienced observers who did not know which radiopharmaceutical was used, and who had no patient data. Diagnosis (positive, negative, doubtful) was made, and image quality (inferior, average, superior) was judged for each study. Two mobile gamma cameras were used and compared with respect to their instrumental characteristics and clinical versatility. In a comparison of IDP with MDP the authors found that five out of 11 MDP scintigrams resulted in false-negative findings in infarction. All nine patients, without infarction were negative in both studies. In the comparison of MDP with PPi the authors found that both agents resulted in positive scans in 13 patients; five patients had negative scans with both tracers; and two studies were positive only with PPi. Therefore seven of 25 acute myocardial infarctions remained undetected with Tc-99m MDP. The authors conclude that Tc-99m MDP lacks sensitivity for detection of acute infarction, and that Tc-99m IDP is the tracer of choice.

Prognostic Value of Radionuclide Angiography in Cerebral Vascular Disease. I. R. Barrett, F. D. Powell, F. S. Mishkin; Los Angeles, California. *Angiology* 30: 257–261, 1979

The prognostic significance of increased venous phase activity during cerebral radionuclide angiography was assessed in 175 patients who had unilateral diminished activity in the arterial phase and neurologic findings that indicated a recent cerebral infarction. All patients were examined within 1 wk after the onset of symptoms. The records were reviewed retrospectively and the patients divided into two clinical categories: (a) those with no clinical improvement; and (b) those with improvement. Statistical analysis revealed a strong association between an increase in activity during the venous phase in the affected hemisphere and clinical improvement. In those showing diminished or equal venous phase activity in the affected hemisphere, the chances against clinical improvement were greater than 6:1. No statistically significant difference was found in mortality rates of the two groups. The finding of increased activity in the venous phase during cerebral radionuclide angiography in these patients appears to be related to the adequacy of collateral perfusion or recanalization.

Testicular Scanning as a Diagnostic Aid in Evaluating Scrotal Pain. R. A. Boedecker, J. R. Sty, J. Z. Jona; Milwaukee Children's Hospital, Milwaukee, Wisconsin. *J Pediatr* 94: 760–762, 1979

Nuclear imaging was used to evaluate testicular perfusion and the degree of testicular tissue pool activity in 32 boys, aged 1–16, who presented with symptoms suggesting possible torsion of a testis. A gamma camera was used to record perfusion at 4-sec intervals during the first minute following an i.v. bolus injection of Tc-99m pertechnetate, 6 mCi/m^2 body surface area. Tissue pool images were recorded at 1, 5, 10, and 15 min following the flow study. A specially designed 1/4 in. lead shield was placed between the scrotum and thighs. Perfusion was unimpaired and tissue pool activity was increased in 25 boys, suggesting hyperemia due to inflammation. Of these, 23 recovered with medical treatment, one required abscess drainage, and one with persistent symptoms underwent surgical exploration. He was found to have torsion of the appendix testis with no impairment of the testicle. The six boys with unilateral decreased perfusion and unilateral decreased tissue pool activity proved to have torsion of the testicular vascular pedicle at surgery. The authors state that the technique has been a most valuable diagnostic aid in cases of suspected testicular torsion when the clinical diagnosis is equivocal.

Preoperative Diagnosis of Splenic Abscess by Ultrasonography and Radionuclide Scanning. J. J. Brown, T. E. Sumner, J. E. Crowe; Bowman Gray School of Medicine, Winston-Salem, North Carolina. *South Med J* 72: 575–577, 1979

The authors report a case of traumatic abscess of the spleen, which was diagnosed preoperatively with ultrasonography and scanning with gallium citrate and technetium sulfur colloid without the need for the invasive technique of angiography. A 14-year-old girl initially presented with fever and pleuritic-type pain in the left chest, radiating to the neck. Tetracycline therapy was begun, but she continued to have spiking fever. On admission, the hemoglobin level was 13.0 g/100 ml and the WBC was 14,000/cu mm with 86 segmented neutrophils. Chest radiographs, throat culture, and urinalysis showed no abnormalities. Five days later, the WBC was 18,000/cu mm, and chest radiographs showed elevation of the left hemidiaphragm. On physical examination, the spleen was palpable 2 cm below the left costal margin but was not tender. In response to repeated questioning, she remembered that approximately 3 wk before admission she had been struck in the left upper abdomen while playing volleyball. Abdominal sonography showed an enlarged spleen with an 8 × 10 cm sonolucent region with irregular margins, more indicative of a hematoma or abscess. Tc-99m sulfur colloid liver-spleen scan showed a large focal defect within the upper half of the spleen. Subsequent Ga-67 citrate scan showed accumulation of radioactivity around the margins of the focal defect, which suggested an inflammatory process. A large abscess cavity was found by exploratory laparotomy, and *Salmonella san diego* was cultured.

Accumulation of Radioiodinated Tyrosine Derivatives in the Adrenal Medulla and in Melanomas. G. Kloss, M. Leven; Frankfurt, Germany. *Eur J Nucl Med* 4: 179–186, 1979

The authors labeled 26 tyrosine derivatives with I-131 to determine adrenal and melanoma uptake. Some of the 26 compounds examined differed only in steric configuration. The preparation of [^{131}I] iodo-α-methyltyrosine is described to illustrate the preparation for all the related compounds. Metabolites were isolated from urine. The isolation of I-(3′-iodo-4′-hydroxy phenyl)-I-hydroxy-2-aminopropane and its metabolites were used to demonstrate this method. The authors used 694 NMRI mice with and without Harding–Passey type melanotic melanoma, 447 hamsters with and without Mohr or Fortner I type melanoma, 722 Wistar rats, 11 rabbits, 36 dogs, and one cat in the study. All small animals received 25 μCi I-131; dogs were given 2 mCi. The liver served as reference organ against which the radionuclide uptake of melanoma and adrenal glands was compared. Autoradiography demonstrated that adrenal uptake occurred in the medulla. Animals were sacrificed 24 hr after injection of the labeled compounds, and well-counter measurements were used to determine tracer concentration of target organs. Radionuclide uptake was calculated for total target organs and per gram of tissue as percentage of administered dose. The authors found I-(3′-iodo-4′ hydroxyphenyl)-I-hydroxy-2-aminopropane (Compound 18) uptake in the adrenal gland of melanoma-affected mice was 57 times greater than the tracer concentration in the liver 24 hr after injection. Sexual differences were noted. The compound that showed greatest accumulation in melanoma was 3-(3′-iodo-4-hydroxyphenyl)-2-methyl-2-aminopropionic acid (Compound 2). Accumulation in melanoma exceeded liver uptake 69:1 in mice. The results appear to be species specific. Compound 18 demonstrated strong adrenal uptake in mice and rats but failed to accumulate in the adrenals of dogs, cats, or hamsters. The authors conclude that species-specific differences appear to exist in the biotransformation of the compounds used and that continued work appears warrented.

Radionuclide Imaging in Subacute Sclerosing Panencephalitis. W. E. Dodson, A. L. Prensky, B. A. Siegel; Malinckrodt Institute of Radiology and Washington University School of Medicine, St. Louis, Missouri. *Neurology* 29: 749–752, 1979

Abnormal radionuclide brain scans were obtained in three patients with subacute acute sclerosing panencephalitis (SSPE) during periods of rapidly progressive disease. One patient showed right occipital tracer localization, the second had increased activity over the left cerebral convexity, and the third patient demonstrated increased activity in both occipital regions and in the left posterior frontal region. The scans were obtained with Tc-99m DTPA following the usual delayed imaging technique. Computerized tomography scans were negative in two of these patients, suggesting that radionuclide brain imaging is more sensitive for detection of the lesions of SSPE. This greater sensitivity is probably due to the longer delay interval in radionuclide brain imaging that permits increased tracer accumulation in the lesion and clearance of activity from the blood and surrounding tissues. Radionuclide brain

imaging with delayed views may also be more sensitive in other inflammatory diseases of the brain.

Xe Radiospirometry: Prediction of VC and FEV. M. M. Nicoli, Y. Jammes, E. Fornaris, G. Giacchero, and P. Coutant; Hôpital Salvator, Marseille, France. *Respiration* 37: 208–214, 1979 (In French)

In adults scheduled for pulmonary lobectomy (45 patients) or pneumonectomy (56 patients), predominantly for cancer, presurgical vital capacity (VC) and one-sec capacity (FEV) were measured by spirometer. Lung ventilation was also measured by gamma camera after inhalation of Xe-133 and after i.v. injection of Xe-133 in saline. Lung scintimages were subdivided into four quadrants, and regional VC values were calculated as a percentage of total radioactivity. By using the regional percentages and the spirometric VC values in addition to considering the extent of surgical resection planned, postsurgical VC values were predicted. Postsurgical FEV values were predicted by using the presurgical VC values and the FEV/VC ratio. Correlation between those predicted values of either VC or FEV and corresponding values measured spirometrically postoperatively was high ($p < 0.01$–0.001) in both surgical groups. The authors conclude that the xenon scan is a useful technique for estimating the consequences of lung removal on ventilation.

Prostatic Acid Phosphatase by Radioimmunoassay Tumor Marker in Bone Marrow. W. D. Belville, H. D. Cox, D. E. Mahan; Walter Reed Army Medical Center and Queens University. *J Urol* 121: 442–446, 1979

Prostatic acid phosphatase was measured in bone marrow aspirates by radioimmunoassay and enzymatic methods in 95 patients with benign prostatic hyperplasia, 50 patients with biopsy-proved metastatic carcinoma of the prostate, and 36 male patients with nonprostatic malignancy. The radioimmunoassay employed a double-antibody technique in which a known amount of radioactive prostatic acid phosphatase is mixed with the unknown and incubated with a specific antiserum of rabbit origin. The subsequent complex is precipitated with a second antibody, and the radioactivity present in the supernatant and the precipitate is measured and compared with values obtained by assays of known amounts of prostatic acid phosphatase. An upper limit of normal was at 12.7 ng/ml and represents the 95th percentile of the population with benign prostatic hyperplasia. Using these criteria, 89% of values from patients with untreated disseminated prostatic cancer exceeded this upper limit. The other malignancies showed lower levels consistently, with 94% less than 10 ng/ml. Patients with prostatic cancer who had undergone hormonal manipulation showed normal values in 71% of cases. The enzymatic method showed considerable overlapping of these populations. The radioimmunoassay seems to be an effective tool to measure the presence of prostatic adenocarcinoma in bone marrow and, because of its quantitative nature, is able to reflect tumor activity. In contrast the enzymatic technique showed limited reliability.

Radiometric Measurement of Differential Metabolism of Fatty Acids by *Mycobacterium Lepraemurium*. E. E. Camargo, J. A. Kertcher, S. M. Larson, B. F. Tepper, H. N. Wagner, Jr; The Johns Hopkins Medical Inst., Baltimore, Maryland. *Int J Leprosy* 47: 126–132, 1979

The production of C-14 labeled CO_2 from a variety of C-14 labeled fatty acids by *Mycobacterium lepraemurium* (Hawaiian) was studied using the following C-14-labeled fatty acids as substrates: butyric, hexanoic, octanoic, decanoic, myristic, palmitic, stearic, oleic, linoleic, lenolenic, and malonic. An ion chamber device was used to measure bacterial metabolism. The actual ^{14}CO-labeled CO_2 output was determined by calculating the difference in radioactivity found in the vial (medium and bacteria) and the known original radioactivity. Assimilation of the substrates was measured by separating the bacteria from the medium and determining the radioactivity present in each by liquid scintillation counting. Radiochromatographic analysis of the fatty acid substrates was also performed. Results showed that with saturated fatty acids, except lauric acid, increased amounts incorporated into the bacteria yielded increased CO_2 production. Preferential oxidation of lauric, decanoic, and myristic acids was found. No oxidation was seen with malonic acid and malonic acid was not assimilated, indicating themalonyl-CoA pathway does not appear to be present in this organism. Future experiments are planned to elucidate the role of lauric acid, which may be a potential growth promoting factor for *M. lepraemurium*. Radiometric measurement of differential fatty acid metabolism may provide a basis of radiometric identification of *M. lepraemurium* and assessment of the growth requirements of this organism.

The Normal Pancreas: Acoustic Characteristics and Frequency of Imaging. Roy A. Filly, Stuart S. London; University of California, San Francisco, California. *J Clin Ultrasound* 7: 121–124, 1979

In a review of 100 abdominal scans the authors found recognizable pancreatic tissue in 65%. Echogenicity of the normal pancreas was also assessed. The normal organ produced a pattern of density equal to that of normal liver in nearly half the instances and greater than normal liver in the remainder. In no case was the normal pancreas less echogenic than liver. The most common causes of failure of imaging pancreatic tissue were bowel gas and obesity. The authors propose infiltration of the pancreas by retroperitoneal fat as a possible explanation for failure to image that organ in the obese patient. Representative ultrasonograms are provided.

Ultrasound Evaluation of Hydronephrosis of Pregnancy. L. M. Erickson, S. F. Nicholson, D. B. Lewall, Lauraline Frischke; Foothills Hospital, Calgary, Alberta, Canada. *J Clin Ultrasound* 7: 128–132, 1979

Ultrasonographic examination of the kidneys in 449 pregnant patients and 39 nonpregnant control subjects yielded an overall incidence of 63% of demonstrable renal pelvic dilatation in the pregnant subjects over the controls. The maximum diameter of the renal pelvis in the nonpregnant state is assumed to be 1.1 cm on the right and 0.9 on the left. In healthy, pregnant patients the maximum renal pelvic diameter was found to be 2.7 cm on the right and 1.8 cm on the left during the last two trimesters of pregnancy. Maximum dilatation occurred at approximately 24 wk for multiparous patients and at 28 wk for primiparous patients. When the degree of dilatation is asymmetric, the right side is more extensively involved than the left in 90% of the cases. The authors include a discussion of the various theories regarding the etiology of such obstruction. Representative ultrasonograms demonstrated the method of measurement.

An Analysis of Pancreatic Sonography in Suspected Pancreatic Disease. Peter H. Arger, Charles B. Mulhern, John A. Bonavita, Dorothy M. Stauffer, John Hale; University of Pennsylvania, Philadelphia, Pennsylvania. *J Clin Ultrasound* 7: 91–97, 1979

In a review of 500 pancreatic examinations by ultrasound the authors found an overall ability to define the head of the pancreas in 77%, the body in 70%, and the tail in 37%. These studies did not include the routine use of prone scanning or the fluid-filled stomach

as an acoustic window. Ninety-seven percent of pancreatic pseudocysts larger than 3 cm were correctly identified in the tail of the pancreas. Normal measurements provided include 1.80 ± 0.12 cm for the head, 1.75 ± 0.14 cm for the body, and 1.75 ± 0.11 cm for the tail. Increase in pancreatic size was identified in both pancreatitis and neoplasm. Tumors that measured less than 2.0 cms were felt to be below the limit of resolution of the current method. Pseudocysts smaller than 3.0 cm could easily be confused with the edematous pancreas. Echogenicity in pancreatic carcinoma was generally less than that of the normal pancreas but displayed a dyshomogeneous pattern. The authors conclude that ultrasound can be effectively used in patients suspected of having pancreatic disease to define both normal and abnormal states.

The Ultrasonic Changes in the Maturing Placenta and Their Relation to Fetal Pulmonic Maturity. Peter A. T. Grannum, Richard L. Berkowitz, John C. Hobbins; Yale University, New Haven, Connecticut. *Am J Obstet Gynecol* 133: 915–922, 1979

Based on a review of the placentas of 129 patients, the authors establish a classification of maturity of the placenta. Grade 0 is a smooth, homogeneous placenta with a smooth unbroken chorionic plate and is seen in the first and second trimesters. Grade 1 shows subtle undulations of the chorionic plate and a few scattered low-level echogenic areas in the placental substance that produce a loss of homogeneity; this grade is first noted commonly from 30 to 32 wk gestation. Grade 2 demonstrates more marked indentations of the chorionic plate with incomplete divisions by forming septa. Echogenic areas are also noted toward the basal layer. Grade 3 changes represent the fully mature placenta; indentations from the chorionic plate extend to the basal layer and echogenic areas close to the chorionic plate are seen with concomitant acoustic shadows. Mature L/S ratios (2.0) were found in 68% of patients with Grade 1 placentas, in 88% of Grade 2, and 100% of Grade 3. The results suggest reliable correlation between maturational changes determined by ultrasonography of the placenta and fetal pulmonic maturity as reflected by L/S ratios.

PEGGY DOMSTAD
ANDREW FRIED
EUSHIN KIM
University of Kentucky
Medical Center and VA
Hospital
Lexington, Kentucky

JOHN H. CLORIUS
Deutsches
Krebsforschungszentrum
Heidelberg, Germany