

## ABSTRACTS OF CURRENT LITERATURE

**Testicular Torsion—The Role of Radioisotopic Scanning.** W. S. Falkowski, C. F. Firlit; Children's Memorial Hospital, Northwestern Univ., Chicago, IL. *J Urol* 124:886-888, 1980

Eighteen patients between the ages of 7 days and 16 yr were evaluated by scintigraphy for scrotal problems. Potassium perchlorate was given followed by intravenous pertechnetate. Twelve 5-sec serial images of the scrotum and delayed images consisting of 500,000 counts were obtained. In four patients, testicular torsion was accurately identified; however, necrosis had already occurred as a result of a previously made inaccurate diagnosis. One patient with a testicular hematoma and one with a hydrocele had scans consistent with these clinical impressions. Epididymitis was also accurately diagnosed. Follow-up scans on those initially read as normal remained normal. Nonoperable conditions may be distinguished from those that are operable by this technique.

**Myocardial Infarct Imaging of Antibodies to Canine Cardiac Myosin with Indium-111-Diethylenetriamine Pentaacetic Acid.** B. A. Khaw, J. T. Fallon, H. W. Strauss, E. Haber; Massachusetts General Hospital, Boston, MA. *Science* 209:295-297, 1980

When myocardial infarction damages the cardiac cell membranes, extracellular molecules can enter the cell. The authors have previously shown that I-125-labeled F(ab')<sub>2</sub> fragments of antibodies to cardiac myosin will concentrate within the infarcted tissue. They described imaging of the same fragments labeled with In-111 DTPA. The purified antibody fragments were reacted with the carboxycarbonic anhydride of DTPA, the product reacted with In-111 chloride and separated by chromatography and dialysis. The antibodies had not lost their reactivity as a result of these reactions. The material created was injected into dogs with experimental myocardial infarcts. The localization of the In-111-labeled antibody fragments correlated with other indicators of myocardial infarction. Successful imaging has also been performed with antibody fragments labeled with Tc-99m DTPA and Ga-68.

**Left Ventricular Diverticulum. A Scintigraphic Diagnosis.** R. Raipal, J. Thomas, J. R. Sty; Milwaukee Childrens Hosp., Milwaukee, WI. *Pediatr Radiol* 10:39-41, 1980

A 12-year-old black girl presented for evaluation of an abnormal cardiac contour in the region of the left ventricle that was originally noted during an examination for pneumonia when she was 8 mo old. She had remained essentially asymptomatic in the interim. Physical examination including cardiovascular assessment was normal. Electrocardiogram (ECG) and echocardiogram were normal. Stress ECG, including Tl-201 myocardial perfusion scintigraphy at maximal work, was normal. After in vivo labeling of erythrocytes with Tc-99m, a multiple-gated acquisition study revealed a normal ejection fraction (0.62). An abnormal prominence of the apical segment of the left ventricle seen during diastole, however, emptied during systole, suggesting a true left ventricular diverticulum that was subsequently confirmed at cardiac catheterization. The congenital fibrous type of left ventricular diverticulum occurs in black subjects, has many characteristics of

a ventricular aneurysm, and is symptomatic. In congenital muscular diverticulum, however, all muscular layers are present (as indicated asymptomatic. On the basis of these findings, a congenital left ventricular muscular diverticulum was diagnosed in this patient.

**Gastroesophageal Reflux in Children: Radionuclide Gastroesophagography.** J. D. Blumhagen, T. G. Rudd, D. L. Christie; Univ. of Washington School of Med., Seattle, WA. *Am J Roentgenol* 135:1001-1004, 1980

Sixty-five infants and young children (majority less than 2 yr old) with symptoms of gastroesophageal reflux were studied. After a 4-hr fast, each patient drank 30 ml of apple juice containing 200  $\mu$ Ci Tc-99m sulfur colloid (Tc-SC) followed by additional fluid bringing total volume to 60-330 ml. Patients then rested supine under a gamma camera for 30-60 min for imaging of thorax and upper abdomen at 5-min intervals. Radioactivity in the esophagus was measured at 30-sec intervals and plotted against time. At end of the baseline period, gentle manual pressure to abdomen in the ensuing 5-min yielded zero to five or more episodes of reflux, which were graded numerically. When compared with results from standard acid reflux tests (ART), sensitivity in detecting reflux by this Tc-SC method and by barium esophagography (BSE) with water-siphon test agreed well. Findings from all three methods considered together indicate that a strongly positive result from any one test tended to be corroborated by one, but not always by both, of the others. For example, in 14 of the patients having endoscopically confirmed esophagitis, ART, Tc-SC, and BSE yielded positive findings in 10, 12, and 13 of the children, respectively. Accordingly, when major decisions regarding treatment must be made, e.g., to determine candidates for antireflux surgery, the authors feel that at least one of the imaging procedures and the acid reflux test must be performed to lessen risk of false-negative findings. Despite the presence of lung disease in several of the children, pulmonary aspiration of Tc-SC radioactivity was never seen.

**Diagnosis of Hepatoma by Scintigraphy Using Multiple Radionuclides.** V. W. Lee, E. Estabaya, J. H. Shapiro; Boston City Hosp., Boston, MA. *J Surg Oncol* 15:133-138, 1980

Differential diagnosis of hepatoma in an elderly woman is described. Physical examination revealed an enlarged and hard liver and clinical chemistry tests for liver function were abnormal. A Tc-99m sulfur colloid (Tc-SC) scan showed hepatosplenomegaly with a large defect in the right lobe of liver above the renal fossa; uptake in the left lobe was irregular. Radionuclide angiography (Tc-99m human serum albumin, Tc-HSA) showed increased vascularity in the right lobe during the arterial phase indicating a blood supply largely from hepatic artery rather than from the portal vein. Static imaging with Tc-HSA confirmed the hypervascularity of the lesion. A scan 72 hr after injection of Ga-67 citrate demonstrated markedly increased radioactivity uptake at the site. Ultrasonography revealed a solid mass, whereas contrast angiography revealed a hypervascular lesion with tumor vessels.

At laparotomy, a large mass was found that extended from the right lobe of liver partly into the left. Histologic examination of the mass revealed hepatoma. The authors favor sequential studies with Tc-SC, Tc-HSA, and Ga-67 for differential diagnosis of this lesion.

**The Effects of Radiopharmaceutical Incubation Time on Bone Scan Quality.** R. E. Henkin, A. Woodruff, W. Chang, A. M. Green; Loyola University, Stritch School of Medicine, Chicago, IL. *Radiology* 135:463-466, 1980

The quality of bone scans was investigated following incubation times ranging from 30 to more than 121 min after preparation of commercial methylene diphosphonate kits. The ratio of bone-to-soft tissue counts was determined from the anterior image of the femoral region. The results showed no scan of poor visual quality in the group of patients injected with material prepared 30 and 60 minutes after reconstitution. The number of patients with good or excellent scans increased with increasing incubation time. The authors postulate that different compounds form in the vial with time, which may alter the clearance data of the scanning agent.

**The Value of Radionuclide Bone Scanning in the Early Recognition of Deliberate Child Abuse.** G. M. Haase, V. N. Ortiz, G. N. Sfakianakis, T. S. Morse; Childrens Hospital, Columbus, OH. *J Trauma* 20:873-875, 1980

Forty-four children presenting at hospital with burns or other injuries were evaluated with skeletal roentgenograms and Tc-99m etidronate (usually 100  $\mu$ Ci/kg) bone scans on the first day of medical care. After inquiry, 24 of the patients were felt to have been intentionally injured. Twenty-six of the patients (including ten abuse victims) had negative bone scans. Of those 26, skeletal radiographs were normal in all but two who had evidence of skull fracture. Other than those two, none of the remaining children developed later evidence of bone or periosteal injury. Of the 18 children (including 14 abuse victims) having initial positive bone scans, initial radiographs revealed fracture in 11 patients but negative results in the remaining seven. In those seven (of whom six were abuse victims), subsequent radiographs several days later in five patients revealed areas of sclerosis or periosteal elevation (the latter resulting from twisting injuries) at sites of focal hyperactivity on initial scan. In suspected child abuse, these authors recommend skull radiographs and total-body bone scans on the first day of medical care. If the bone scan reveals additional positive sites, only those sites should be examined by radiographs on the first day and perhaps at later dates if initial roentgenogram at such sites is negative. After an initial negative bone scan, the authors feel that a bone scan repeated later would probably be nonproductive.

**Normal Technetium Bone Scans in Patients with Acute Osteomyelitis.** I. D. Berkowitz, W. Wenzel; Univ. of Colorado. *Am J Dis Child* 134:828-831, 1980

Technetium bone scintigraphy has proved very useful in the diagnosis of osteomyelitis and in the differentiation of this disease process from cellulitis, bone infarction, and septic arthritis. This report describes the occurrence of falsely normal Tc-99m medronate (MDP) scans in seven patients with acute osteomyelitis. The patients were children ranging in age from 3 wk to 8 yr. All had clinical symptoms of acute osteomyelitis: radiographs and Tc-99m MDP scans were performed within 48 hr after admission and interpreted as normal. The presence of acute osteomyelitis was confirmed on repeat radiographs 8-16 days after onset of symptoms in four patients, by abnormal Ga-67 scans alone in two pa-

tients, and by an abnormal Ga-67 scan and positive culture in one patient. Repeat Tc-99m MDP scans were not performed. It is postulated that vascular complications resulting from the acute osteomyelitis may produce areas of metaphyseal ischemia. The net effect of the ischemia is to offset the increased radionuclide extraction produced by osteoblastic activity, yielding a falsely normal bone scan. The ischemic changes may also explain the occasional cases of acute osteomyelitis presenting as foci of decreased radioactivity on the bone scan. The frequency of falsely normal bone scans in acute osteomyelitis could not be accurately determined in this study.

**Modeling Coordination Sites in Metallobiomolecules.** J. A. Ibers, R. H. Holm; Northwestern Univ. and Harvard Univ. *Science* 209:223-235, 1980

The radioactive nuclides with the friendly energy and emission characteristics are usually metals rather than isotopes of the most common biological elements (H, C, N, O). Therefore, radiopharmaceutical chemists are most often faced with the creation of metallobiomolecules to combine the gamma emitter with biological activity. The authors here consider the current status of synthetic chemical approaches to the active sites of molecules, such as electron carriers, oxygen binders, and enzymes. The incorporated metal is usually at the active site of the natural biometallic molecule. Models of these active sites are simpler molecules with the metal in the same configuration. This paper is a fine discussion of the types of compounds and the models.

**Vascular Permeation of Platelet Factor 4 After Endothelial Injury.** I. D. Goldberg, M. B. Stermerman, R. I. Handin; Harvard Medical School, Boston, MA. *Science* 209:611-612, 1980

Platelets adhere to the exposed subendothelium of injured blood vessels. The authors studied the entry of a platelet protein, platelet factor 4 (PF4), into the vessel wall. Immunofluorescent antibodies to PF4 were used to detect the protein and to follow its disappearance. A low-pressure balloon catheter was used to damage rabbit iliac arteries; the rabbits were killed at selected intervals after injury and the arteries prepared for testing. PF4 was seen in the luminal surface and tunica media at 10 and 30 min and was visible at 240 min, but much diminished. Other studies have shown that an injured vessel wall becomes covered with platelets very soon after injury and as repair takes place, the platelets disappear. This study demonstrates the permeation of the platelet protein into the vessel wall. The authors hypothesize that other platelet proteins that are secreted in response to the same stimuli as PF4 also enter the vessel wall, some of which may stimulate vascular repair. The technique described in this paper can be used to follow platelet proteins and investigate their effects.

**Evaluation of an Automated Radioimmunoassay for Serum Cortisol.** R. Valdes Jr., M. R. Wills, J. Savory; Washington Hosp. and Jewish Hosp. Med. Ctr., St. Louis, MO. *Ann Clin Lab Sci* 10:508-514, 1980

A commercial instrument incorporating automated continuous-flow methodology and anion-exchange column chromatography for unattended radioimmunoassay (RIA) of serum cortisol concentration is described. All reagents, standards, and control sera required were supplied by the instrument manufacturer. Serum volume for assay was 13  $\mu$ l. Standard curve fitting routines available are logit-log, weighted logit-log, and third-order polynomial, with the last one used in this study. The standard curve ranged from 10-500  $\mu$ g cortisol/l. The instrument printed the complete standard curve within 17 min from start of assay (per-

mitting assessment of curve quality) just before printing sample and control results at 85-sec intervals thereafter. Serum cortisol from separate groups of 52 and 34 patients was measured by different manual cortisol RIAs and by an automated method (latter running at 42 determinations/hr) resulting in good agreement between each manual method and automated one ( $r = +0.96$  and  $+0.93$ , respectively). When measuring a control serum with a mean concentration of  $160 \mu\text{g}$  cortisol/l, intra-assay and interassay precision were 5.1 and 7.2% (relative standard deviation), respectively. Three control sera counted sequentially in groups of ten samples for a total of 213 determinations over 5.2 continuous hours revealed negligible system drift (indicated by radioactivity counts in bound fraction) or sample carry-over (from one cortisol concentration to the next) during the period.

**Spironolactone Interference with Digoxin Radioimmunoassay in Cirrhotic Patients.** J. T. DiPiro, J. R. Cote, C. R. DiPiro, J. A. Bus-track; Univ. of Kentucky Med. Ctr., Lexington, KY. *Am J Hosp Pharm* 37:1518-1521, 1980

Apparent digoxin concentration of 0.7-2.6 ng/ml serum (mean 1.3) was obtained by radioimmunoassay (RIA) in ten patients (Group 1) with alcoholic cirrhosis who were taking spironolactone (an aldosterone antagonist) in a daily dose of 50-400 mg (mean 180) but who had *not* been receiving digoxin. Such mean digoxin level (within the therapeutic range for digoxin) was higher ( $p < 0.01$ ) than that measured in ten control patients (Group 3; 0-0.9 ng digoxin/ml, mean 0.4) not having cirrhosis and receiving neither spironolactone nor digoxin. In Group 2, ten cirrhotic patients not receiving spironolactone or digoxin had an apparent mean digoxin concentration of 0.74 ng/ml (range 0-1.3), which was significantly less than that in Group 1 ( $p < 0.05$ ) but no different from that in the controls ( $p > 0.05$ ). In Group 1 patients, measured digoxin level was positively correlated with patient prothrombin time/control ratio. This study found that treatment of a patient with spironolactone led to a greater cross-reactivity of drug or metabolite in a digoxin RIA than had been reported previously. These authors advise caution when interpreting digoxin levels obtained by RIA in patients with cirrhosis and/or being treated with spironolactone.

**Excretion of  $^{125}\text{I}$  in Breast Milk Following Administration of Labeled Fibrinogen.** N. Veall, I. Smith; Clinical Research Centre, Harrow, Middlesex England; C. S. Bowring, P. L. Ormsby, D. H. Keelling; Plymouth, England. *Br J Radiol* 53:512-513, 1980

These letters are in response to an article on the possible dose to the thyroid of a breast-fed infant whose mother received I-125-labeled fibrinogen. The original article predicted a dose of over 400 rad to the infant thyroid for an administered dose to the mother of  $100 \mu\text{Ci}$ . Apparently, calculations were based on an assumption that the I-125 was carrier free. However, the postinjection course of potassium iodide given to the mother would also protect the infant's thyroid. It is estimated that the administration of KI may reduce the dose to the infant's thyroid by a factor of 100.

Bowring et al. point out that there may be considerable variation in the clearance half-time of radioactivity in the mother's milk. They suggest that both the level of activity in the milk and the clearance half-time should be measured. These data can be used to determine how long thyroid blocking should be continued and when nursing can be resumed.

**Monitoring of I Excretions and Used Materials of Patients Treated with  $^{131}\text{I}$ .** K. Nishizawa, K. Ohara, M. Ohshima, H. Mackoshi, T. Orito, T. Watanabe; Nagoya Univ., Nagoya, Japan. *Health Phys* 38:467-481, 1980

The administration of large doses of radioiodine for the treatment of thyroid disease requires special precautions from the standpoint of radiation safety. In this article two patients treated with 50 and 30 mCi of I-131 and several patients treated with 2-5 mCi of I-131 were monitored to determine (a) the maximum excretion rate of iodine into sweat, exhaled air, and saliva; (b) the contamination of linen, underwear, dishes, eating utensils, and toothbrushes; and (c) the air concentration of I-131. The maximum concentration of I-131 in exhaled air was observed approximately 1 hr after administration and contributed directly to air contamination. Whereas the peak concentration in blood occurred shortly after administration, the maximum concentration in perspiration occurred at 24 hr. Measurements indicated that less than 2% of the I-131 in perspiration evaporated into the air. The concentration of radioactivity in saliva averaged approximately 100 times that of blood and decreased, with an effective half-life of 11 hr. Eating utensils and especially toothbrushes showed considerable contamination from the highly active saliva. Contamination can be reduced by avoiding direct contact with the patient, linen, eating utensils, etc. If the patient wears a face mask, direct contamination from mouth spray will be minimized. Information provided in this article should be helpful in minimizing exposure of personnel associated with patients receiving I-131 for therapeutic purposes.

**Feature Extraction for Texture Classification.** H. Wechsler, T. Citron; Univ. of Wisconsin, Milwaukee, WI and Purdue Univ. *Pattern Recognition* 12:301-311, 1980

Texture analysis has been used in nuclear medicine in an attempt to classify disease in certain organs, such as the liver. It is obvious that texture plays a large part in the diagnosis of disease from all the imaging modalities. The human eye and brain seem to experience little difficulty in texture classification and analysis, whereas computers have more difficulty. Wechsler describes two methods of texture classification. The method involves having the computer discover how well the texture of the data at hand matches a prototype texture. Each small block of data is classified as smooth or not after a simulated random walk through the block. Thirty-two textures varying from woven cloth through beach pebbles to fur were each classified by quadrants and matched to themselves. There was a remarkable degree of agreement, showing very little confusion of one texture with another by the computer algorithm.

**Proton Imaging for Medical Applications.** S. L. Kramer, D. R. Moffett, R. L. Martin, E. P. Colton, V. W. Steward; Accelerator Research Facilities Division, Argonne National Laboratory. *Radiology* 135:485-494, 1980

To study the advantages of proton imaging, a 205 MeV beam of protons was obtained from the Booster I synchrotron at Argonne National Laboratory. The data were taken using a narrow scanning beam. The relative light output was determined from a ratio of the integrated light output from four scintillation detectors placed upstream of the specimen box to the output of similar detectors downstream of the box. The off-line analysis consisted of: (a) calculating the relative light output ratio for each beam and scan point; (b) correcting for pulse-to-pulse energy fluctuations; (c) converting the ratio to an equivalent mass of water penetrated; and (d) displaying the mass data as a function of beam position on a gray-scale display.

Proton imaging was shown to provide either a significant and demonstrable improvement in mass resolution for a given dose or a dose reduction for a given mass resolution when compared with radiographic techniques. The possibilities of proton tomographic imaging were discussed.

**Ultrasound Measurement of Fetal Limb Bones.** J. T. Queenan, G. D. O'Brien, S. Campbell; King's College Hospital, London, England. *Am J Obstet Gynecol* 138:297-302, 1980

Serial measurements of the humerus and femur, and radius-ulna and tibia-fibula complexes were made beginning at 10 wk gestation. Use of a real time ultrasound device facilitated obtaining the maximum lengths of the individual bones. From a series of 41 patients normal values for the various bones at given gestational ages up to 22 wk were derived. The establishment of these normal values allowed diagnosis of the presence or absence of skeletal dysplasias in four patients at risk for such problems. Tables, graphs, and sonograms are provided.

**Grey-scale Ultrasonography in the Evaluation of Carcinoma of the Gallbladder.** L. D. Palma, G. Rizzato, R. S. Pozzi-Mucelli, M. Baz-zocchi; University Hospital, Trieste, Italy. *Br J Radiol* 53:662-667, 1980

In a study of 18 cases of gallbladder carcinoma, the authors encountered two basic patterns, one involving various sized masses occupying all or part of the lumen and the second in which uneven thickening of the wall of the gallbladder was observed. Stones were a frequent concomitant finding as was dilatation of the biliary tree in jaundiced patients. A gallbladder totally replaced by neoplasm may mimic masses in adjacent organs or the porta-hepatis. Poor definition of the interface between gallbladder and liver is suggestive of extension of the neoplasm outside the gallbladder capsule. An overall accuracy of 88.8% in the diagnosis of carcinoma of the gallbladder was obtained. Line drawings and the corresponding sonograms are provided.

**The Ultrasonic and Biochemical Diagnosis of Pancreatitis in Children.** K. L. Cox, M. E. Ament, W. F. Sample, D. A. Sarti, M. O'Donnell, W. J. Byrne; Univ. of California-Davis Med. Ctr., Sacramento, CA. *J Pediatr* 96:407-411, 1980

In a series of 17 normal subjects the echogenicity of the pancreas was equal to or greater than that of the left lobe of the liver, as has been described in the adult. In 13 of 35 children with abdominal

pain, decreased echogenicity of the pancreas was correlated with the clinical and/or biochemical picture of pancreatitis. In only five of this latter group was frank enlargement of the gland confirmed. The authors found the serum amylase levels and amylase creatinine clearance ratios to be unreliable tests for diagnosing pancreatitis and suggested pancreatic ultrasonography be performed on children with unexplained acute and chronic abdominal pain.

**Ultrasonic Evaluation of the Pancreatic Duct.** S. G. Parulekar; Mount Sinai Hospital of Cleveland, Cleveland, OH. *J Clin Ultrasound* 8:457-463, 1980

The author was able to identify the normal pancreatic duct in 82% of patients examined in a prospective study. The mean diameter of the normal pancreatic duct of Wirsung was 1.3 mm, and a duct of greater than 2 mm in diameter raised the suspicion of pancreatic pathology. The smallest pancreatic duct lumen measured was 0.6 mm in diameter. The pancreatic duct was dilated in almost all patients with acute pancreatitis, in some with chronic pancreatitis, and in some with pancreatic neoplasms. Pitfalls included mistaking portions of the splenic artery and posterior gastric wall for a segment of pancreatic duct. Visualization of the pancreatic duct does not necessarily imply pathology. For clinical purposes, caliper measurement of the duct is sufficiently accurate. Examples of both normal and pathologic pancreatic ducts are shown as well as sonograms of common pitfalls.

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