ABSTRACTS OF CURRENT LITERATURE

Scintigraphic Evaluation of Childhood Malignancies by "Ga-Citrate. C. Bekerman, R. B. Port, E. Pang, J. W. Moohr, and J. K. Kranzler; Michael Reese Hospital and Medical Center. *Radiology* 127: 719–726, 1978.

The purpose of this study was to evaluate Ga-67 scintigraphy in patients with specific types of childhood malignancies. The study group included 35 patients aged 6 mo to 16 yr. Thirteen patients had lymphoreticular neoplasms, 11 had soft tissue sarcomas, eight neuroblastomas, and three primary bone tumors. Whole-body scans were performed 72 hr following the injection of Ga-67 citrate, 50-70 microcuries/kg body weight. Results were analyzed for the ratios true positive, false positive, true negative, false negative, and tabulated according to tumor type and sites of tumor involvement. The Ga-67 scan proved to be highly accurate and at times more sensitive than chest roentgenogram for the detection of mediastinal lesions in patients with lymphoreticular neoplasms, and may be useful as a substitute for the lymphangiogram in these patients. Gallium-67 scans were useful in the evaluation of the primary tumor and of metastases from soft tissue sarcomas, although chest roentgenogram appeared more sensitive in detecting lung metasases. Poor results were obtained in the neuroblastoma group, indicating that the Ga-67 scan is not useful for the staging of these patients.

Tumor Visualization Using Galilum-67 Scintigraphy in Children. C. J. Edeling; Rigs Hospital. *Radiology* 127: 727–731, 1978.

This investigation presents the results of Ga-67 scanning in 122 children studied from 1970 to 1977. It was found that Ga-67 scanning may reveal primary tumors, local recurrence, or metastases, corresponding to results for adults. For the final diagnosis of malignant disease, diagnostic sensitivity was 78%, and diagnostic specificity 79%. The prevalence of malignant disease was 55%.

Bone Scintigraphy in Early Diagnosis of Perthes' Disease. O. J. Fasting, N. Langeland, I. Bjerkreim, L. Hertzenberg, and K. Nakken; Acta Orthopaedica Scand 49: 169–175, 1978.

Since radiographs are normal during the early stage of Perthes' disease, the authors evaluated the clinical usefulness of bone scintigraphy for early disease detection. Twenty-four patients were examined within 4 mo of the onset of symptoms. Radiographic findings were lacking or only suggestive of initial development of disease. Gamma camera scintigraphy was carried out after injection of 2-6 mCi of Tc-99m pyrophosphate. (The radiopharmaceutical dosage was age dependent.) Images were obtained in AP position using a parallel-hole and pinhole collimator. Eighteen of the 24 patients included in the study developed Legg-Perthes' disease documented in the radiographs. Twenty hips were affected, and initial radiographs demonstrated the disease 18 times. Two hips appeared normal initially, but developed typical radiographic changes later. Scintigraphy revealed a pathologic uptake with decreased activity in the capitulor femoral epiphysis in all cases of Perthes' disease. The affected hips failed to show increased radionuclide accumulation in any patient during the early stage of the disease. Six patients with clinical signs suggestive of Perthes' disease but with normal initial radiograph and the normal controls 4 mo later showed increased tracer concentration in the affected joints. Those patients who didn't develop radiographic signs of the disease were considered to have a transient synovitis of the hip joint. The authors conclude that bone scintigraphy will detect Perthes' disease early when radiographs may not yet establish the diagnosis.

Radiographic and Radionuclide Findings in Rhizopus Osteomyelitis. P. H. Moore, R. G. McKinney, F. A. Mettler; University of New Mexico. *Radiology* 127: 665–666, 1978.

An 18-year-old woman with Fanconi anemia developed intermittent right hip pain complicated by steroid therapy, infections, cataracts, and osteoporosis. Routine radiographs of the hip and pelvis were negative for the common findings of osteomyelitis. A month later, the pain radiated down the right lateral thigh, but the radiographic findings were unchanged. A Tc-99m pyrophosphate scan revealed slightly increased radionuclide activity in the region of the right acetabulum and greater trochanter. The level of radioactivity was not felt to be sufficient to warrant the diagnosis of osteomyelitis. Routine radiography and tomography at that time confirmed a destructive lesion of the right femoral neck and greater trochanter. Open biopsy and needle aspiration were performed with subsequent identification of Rhizopus. For this microorganism the radionuclide and radiographic findings differ from those of osteomyelitis secondary to common pathogens: low-level concentration of the radionuclide is observed, but soft-tissue swelling, periosteal reaction, and loss of fascial margins are absent. Whether the low-level activity is a function of chronicity or is peculiar to Rhizopus is not known.

Technetium "Tc" Pyrophosphate Scanning in the Assessment of the Painful Hip Prosthesis. D. P. McInerney and I. D. Hyde; Dr. Steeven's Hospital, Dublin, Ireland. *Clinical Radiology* 29: 513-517, 1978.

Technetium-99m pyrophosphate bone scans were carried out on 35 patients who complained of persistent hip pain following total hip replacement. In those patients who had normal scans the symptoms either resolved or greatly improved. Of 29 patients with abnormal scans, 17 subsequently were found to have infection or loosening of the prosthesis. False positives, including Paget's disease, protrusion of the prosthesis, and heterotopic ossification, also caused scan abnormalities. The authors conclude that scanning of patients who have symptoms following hip prosthesis is valuable in detecting abnormalities when serious complications are present or are likely to develop.

Differential Shunting in the Diagnosis of Patent Ductus Arteriosus with Eisenmenger Physiology by Radionuclide Angiography. J. L. Thomas, J. Scherer, F. R. Kahl, N. Watson, R. Cowan; Thomas Jefferson University. *Radiology* 127: 733–734, 1978.

A 35-year-old woman with a differential cyanosis characterized by clubbed toes more cyanotic than the fingers, was evaluated by radionuclide angiography with technetium-99m. Sequential 1-sec images obtained over the chest revealed radioactivity in the descending aorta before the appearance of activity in the lung fields or left heart. These findings indicated a right-to-left shunt, probably at the great vessel level. To assess the magnitude of the R-to-L shunt, total-body image was obtained with 4mCi of Tc-99m labeled macroaggregated albumen and demonstrated significant activity in the abdomen, especially the kidneys. There was no evidence of activity in the head, which indicated differential shunting into the lower body. The radionuclide findings of differential R-to-L shunting at the level of the ductus arteriosus indicate a patent ductus arteriosus with an Eisenmenger physiology (process of shunt reversal secondary to pulmonary vascular changes).

The authors felt that the radionuclide angiographic scan is rapid, safe, and specifically demonstrates differential shunting with reversal of flow through the patent ductus arteriosus.

Echocardiography and Perfusion Scintigraphy in Diagnosis of Pulmonary Arteriovenous Fistula. A. B. Lewis, G. F. Gates, P. Stanley; Children's Hospital of Los Angeles. *Chest* 73: 675–676, 1978.

The authors report a case of pulmonary arteriovenous fistula in which two minimally invasive techniques, contrast echocardiography and radionuclide lung perfusion scintigraphy, were useful in establishing the diagnosis. Contrast echocardiography revealed the appearance of ultrasonic reflections in the left atrium 1.5-2 sec after their appearance in the right ventricular outflow tract. Lung perfusion scintigraphy revealed a large perfusion defect in the left apex and total body scanning showed a 46% right to left shunt. Significant additional systemic fistulas were excluded by brain and liver and spleen scanning. Findings at cardiac catheterization estimated a 41% right to left shunt. Selective pulmonary angiography demonstrated a large arteriovenous fistula involving the left upper lobe. This large vascular mass was resected at surgery yielding immediate correction of the patient's blood gas abnormalities.

Cerebral Radionucide Scintigraphy in the Stroke Syndrome. J. Booker, N. Morris, C. Y. Huang; Sydney, Australia. *Med J Aust* 1: 625–630, 1978.

The authors sought to assess the contribution of dynamic and static cerebral imaging in the diagnosis of the stroke syndrome. They retrospectively evaluated the radionuclide studies of 365 patients referred with the clinical diagnosis of stroke. The study did not attempt to differentiate persons with cerebral infarction from those with cerebral hemorrhage. Dynamic studies in the anterior projection were made after injection of 20 mCi Tc-99m using a gamma camera equipped with a parallel-hole collimator. Four-view static scintiphotoscans were obtained 1-4 hr later. Only those scans that showed unequivocal areas of increased radionuclide uptake or dynamic studies with consistent asymmetry of flow were reported as abnormal. There were 209 (57%) radionuclide studies found to be abnormal. Of these, 73 patients had both pathologic static scintigrams and dynamic studies; 67 had only abnormal static scintiphotoscans, and 69 showed abnormal serial scintiphotograms. Pathologic scintiphotoscans therefore occurred 140 times (38%); 70% of the lesions appeared in the area supplied by the middle cerebral artery; 14% in "watershed zones"; 12% in the area of the posterior cerebral artery; and 4% were multiple. Dynamic imaging increased the rate of positive results by 50%. Normal static scintiphotoscans were found in 62% of the stroke patients. Probable causes of falsenegative static scintigrams were: scanning too soon after onset of symptoms (10%), late scanning (9%), vertebrobasilar stroke (6%), and lacunar strokes (4%). Thirty-three percent of falsenormal static scans could not be explained. The authors conclude that static cerebral scintigraphy can be expected to detect more than 50% of strokes in the carotid artery distribution; the positive yield of the studies increased by 50% when dynamic studies are routinely used.

An Evaluation of the Use of "Tc~dimercaptosuccinic Acid (DMSA) as a Static Renai Imaging Agent. J. B. Bingham and M. N. Maisey; Guy's Hospital, London. British Journal of Radiology 51: 599– 607, 1978.

The clinical value of Tc-99m-dimercaptosuccinic acid as a static renal imaging agent was analyzed in 366 patients. It was found most useful in the evaluation of mass lesions of the kidney when the findings were equivocal on i.v. pyelography. A comparison of divided function with DMSA was made with Tc-99m labeled DTPA. When the DMSA renal uptake at 3 hr postinjection was compared with the Tc-99m DTPA uptake between 9 and 150 sec after injection, there was a good correlation between the two methods for determination of divided renal function. The authors point out that the value of DMSA as an agent for

imaging mass lesions is likely to diminish with the increase in the use of ultrasound.

In Vitro Interaction between "Tc"-Labeled Pyrophosphate, 3P-Labeled Pyrophosphate and Rat Tissues. M. Rohlin, A. Larsson, and L. Hammarström; Malmö, Sweden. Eur J Nucl Med 3: 249–255, 1978.

The purpose of the study was to investigate the in vitro affinity of Tc-99m pyrophosphate (PPi) for skeletal and soft tissues, particularly in the presence of enzymes capable of splitting the bone seeker. The results were compared with those obtained with P-32 PPi. Five- to ten-day-old anesthetized rats, mounted on a microtome, were immersed in a mixture of hexane and CO₂. Twenty μ m-thick slices were cut, freeze-dried, and brought to room temperature in an air-tight box. Some sections were demineralized in .1 M EDTA in a trismaleate buffer and sucrose solution. The whole-body sections were incubated in solutions containing P-32 PPi, Tc-99m PPi, and Tc-99m at pH 7.6 and pH at 8.6. Autoradiography and/or staining followed. The staining identified orthophosphate ions, captured by Pb^{\$+}, and visualized as lead phosphate after contact with ammonium sulphide. The authors found similar distribution patterns with Tc-99m PPi and P-32 PPi at pH 7.6. At pH 8.6 the tissue distribution of Tc-99m PPi was similar to that of Tc-99m, with no specific affinity for mineralized tissues but with moderate uptake in soft tissue. The uptake pattern of Tc-99m PPi at pH 7.6 was also similar to that of P-32 PPi at pH 8.6; i.e., P-32 PPi demonstrated no pH dependency. The authors concluded that the pronounced labeling of mineralized tissues with Tc-99m PPi and P-32 PPi demonstrates that in vivo metabolism of the radiopharmaceutical is not necessary for the deposition of the bone seeker. The pH-dependent behavior of Tc-99m PPi indicates that Tc-99m is split from the pyrophosphate moiety. This view was supported by lead phosphate formation seen at Ph 8.6 but not at pH 7.6. Enzyme activity did not appear important for Tc-99m PPi accumulation in bone.

The Effect of L-Dopa and Reserpine on the Accumulation of ¹⁴C-Methionine and ¹⁴C-Phenylalanine in the Cerebral Regions of Rats. J. Antal and E. Jászsági-Nagy; Budapest, Hungary. *Radiobiol Radiother* 4: 416–423, 1978.

The authors investigated the effect of L-dopa and reserpine on the incorporation of C-14 methionine and C-14 phenylalanine in the rat's brain. Male rats, 150 ± 10 g, were used for the studies. Ten rats were injected with 200 mg/kg of L-dopa 30 min before i.v. administration of 6.3 μ Ci of C-14 methionine. Ten animals served as controls and received 6.3 μ Ci of C-14 methionine and an equal volume of saline instead of L-dopa. Nine animals were given 0.6 mg/kg reserpine 60 min. before the i.v. injection of 6.3 μ Ci of C-14 methionine, and ten rats served as controls. Five animals were given 12.5 μ Ci of C-14 phenylalanine 60 min after i.v. injection of 200 mg/kg L-dopa, and four rats served as controls. The last group of five rats received the labeled phenylalanine 30 min after i.v. injection of 0.6 mg/kg reservine, and four animals served as controls. The animals were killed, and the plasma radioactivity and the brain tissue activity were measured. Scintillation cocktails were prepared from half of the brain and from five brain regions, and a well counter used for the measurements. The authors found that L-dopa resulted in reduced incorporation of methionine in the brain. Reserpine brought about significantly increased methionine incorporation in all areas of the brain. Phenylalanine distribution was relatively constant in all regions of the brain of control animals. L-dopa resulted in a marked enrichment of phenylalanine, particularly in the cortex. Reserpine led to a marked reduction of phenylalanine uptake, most pronounced in the hypothalamus and in the brain stem. As expected, the influence of L-dopa and reserpine was antagonistic, but the influence of reserpine was more pronounced than that of L-dopa. The authors conclude that the therapy for Parkinson's disease may bring about changes of great magnitude, hardly suspected a few years ago.

Measurement of Urinary Renin Activity by Radioimmunoassay: Sequential Studies in Acute Renal Failure in Man. W. E. Haley and J. W. Johnson; Medical University of South Carolina. *Nephron* 20: 273–285, 1978.

Sequential measurements of urinary renin activity (URA) and plasma renin activity (PRA) were performed in five patients with oliguric acute renal failure (ARF). Obstructive uropathy and prerenal causes were excluded in all patients. Because PRA values were inconsistent in ARF and did not reflect intrarenal events, the authors sought to develop a practical radioimmunoassay technique for the determination of URA. Their method was shown to be highly sensitive, and analyses of within-assay and between-assay determinations demonstrated a high degree of precision and reproducibility. Quantitative recovery of synthetic ileu-5-angiotensin I was obtained and angiotensin I was shown to be generated linearly by the urine-substrate mixture, which indicated that the end-product was protected from proteolytic attack. The end-product of the incubation of urine with plasma substrate was found to be similar to angiotensin I in all respects tested. Urinary renin activity was found to be markedly elevated in the early oliguric phase of patients with ARF and declined to low levels with recovery. The fall in URA preceded the resolution of oliguria and, therefore, appeared to reflect sequential intrarenal events rather than the dilutional effect of increasing urine volumes. Plasma renin activity was not persistently elevated during acute renal failure.

Thyroglobulin Levels in Serum and Saliva of Patients with Differentiated Thyroid Carcinoma. D. Shah, S. Dandekar, and R. D. Ganatra. *Proceedings of Indian Academy of Sciences, B* 87 B: 169–177, 1978.

The authors developed a radioimmunoassay procedure for serum thyroglobulin with a sensitivity of 0.1 ng/ml by a doubleantibody technique. Serum thyroglobulin levels were estimated in ten normal subjects and in 39 patients with papillary and/or follicular thyroid cancer. In normal subjects serum thyroglobulin levels ranged from 1 to 20 ng/ml. Patients with thyroid cancer who had been treated appropriately with total thyroidectomy and subsequent radioiodine ablation and who had no evidence of functioning thyroid tissue demonstrated normal levels of serum thyroglobulin. Of the 11 patients with functioning metastases in the lung, ten had thyroglobulin levels within the normal range, whereas only one had an elevated serum level of 50 ng/ ml. Six patients with functioning bone metastases showed serum thyroglobulin levels above 1000 ng/ml. The presence of antithyroglobulin antibodies was excluded in all of the sera tested for thyroglobulin levels. Salivary thyroglobulin levels in eight normal subjects ranged between 0.8 and 7.0 ng/ml, but in thyroid cancer patients with bone metastases the levels were higher than 20 ng/ml. Usually the salivary thyroglobulin levels demonstrated the same trend as that of the serum thyroglobulin levels but were in a lower range. The presence of very high levels of serum and salivary thyroglobulin in patients with thyroid cancer and bone metastases is most intriguing and its significance should be investigated.

Prone View Ultrasonography for Pancreatic Tail Neoplasms. H. M. Goldstein and C. S. Katragadda. *Am J Roentgenol* 131: 231–234, 1978.

The authors present six cases in which scanning the patient

in the prone position using the left kidney and spleen as a sonographic window provided clear definition of neoplasms of the pancreatic tail. In four cases lesions were detected anterior to the kidney, anterior to both kidney and spleen in one, and anterior to the spleen only in one. Gastrointestinal gas obliterates visualization of the left upper quadrant in many instances and renders the prone scan the only effective means of visualizing the area of the pancreatic tail. Left adrenal masses, enlarged peripancreatic nodes, and a fecal-filled splenic flexure may all produce pictures indistinguishable from primary pancreatic neoplasms. The prone scan for visualization of the pancreatic tail has been previously described—the authors present documentation of its clinical usefulness.

Ultrasonic Demonstration of Inferior Vena Caval Involvement with Right Adrenal Gland Masses. M. E. Bernardino, H. I. Libshitz, B. Green, H. M. Goldstein. J Clin Ultrasound 6: 167–169, 1978.

In a series of 13 documented neoplasms of the right adrenal gland, the authors found displacement and/or indentations of the posterior aspect of the inferior vena cava in nine patients. This is not an unexpected finding in view of the intimate relationship of the right adrenal gland with the posterior aspect of the inferior vena cava. Metastatic neoplasms accounted for the majority of the present series. Additional causes of posterior caval involvement include renal cell carcinoma, metastasis to retroperitoneal nodes, lymphoma, and retroperitoneal sarcoma. Anterior indentation of the inferior vena cava may be caused by the caudate lobe of the liver and the head of the pancreas.

Determination of Renal Volume by Ultrasound Scanning, S. N. Rasmussen, L. Haase, H. Kjeldsen, and S. Hancke. J Clin Ultrasound 6: 160–164, 1978.

The authors describe a method of in vivo determination of renal volume. Having determined the longitudinal axis of the kidney, a series of transverse scans were obtained and the areas of the sections calculated. Digitizing is accomplished by means of a pencil-follower interfaced with a computer and area calculations and volume computations obtained electronically. Highly significant positive correlations were achieved between calculated and true volumes when compared with autopsy specimens. Renal volume determination may be of value for evaluating possible compensatory hypertrophy in patients with renal hypertension, for correlating renal size to renal function, and for evaluating the transplanted kidney with respect to rejection and its response to therapy. The transplanted kidney, by virtue of its usual anterior placement, is more easily evaluated than the kidney in normal position. The authors could not detect significant differences between volumes of the right and left kidneys or between kidney volumes in men and women, if the volumes were related to body weight or surface area.

Ectopic Pregnancy: Criteria and Accuracy of Ultrasonic Diagnosis. T. L. Lawson. Am J Roentgenol 131: 153-156, 1978.

In a series of 235 patients examined for the possibility of ectopic pregnancy, 26 ectopic pregnancies were confirmed and the diagnoses were made by ultrasound in 77%. The false-negative rate was 23%, a false-positive diagnosis of ectopic pregnancy was made in eight cases. An adenexal or cul-de-sac mass was found in all cases of ectopic pregnancy, however the mass could not be distinctly separated from the uterus in some 67%. A definite extrauterine gestational sac was identified in only four

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patients. Identification of fluid in the cul-de-sac by ultrasonography is an important aid in the diagnosis and was present in 23% of the patients who ultimately proved to have ectopic pregnancies. In six cases with a false-negative ultrasonic diagnosis, adenexal masses were observed but were misinterpreted as bowel loops, ovarian lesions, or inflammatory disease. Corpus luteum cysts tend to be larger than ectopic gestations; small cysts, however, with hemorrhage, can be mistaken for ectopic gestations. The hyperplastic endometrium within the uterine cavity can be differentiated from the true gestational sac by the lack of the echogenic rim surrounding the normal gestational sac. The ultrasonic differential diagnosis of ectopic pregnancy includes acute and chronic pelvic inflammatory disease and corpus luteum cysts; more rarely dermoid cysts, uterine leiomyomata and endometriosis may similulate this entity. Scans of the various presentations of ectopic gestations were presented.

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BOOKS RECEIVED

CRC Manual of Nuclear Medicine Procedures, 3rd ed., John W. Keyes, Jr., ed. 213 pp.West Palm Beach, Florida, CRC Press, Inc., 1978 \$29.95, outside U.S. \$34.50

Histology Review 2,000 multiple choice questions and referenced answers, Fred Jerrold Roisen and Linda Hsu. 247 pp. Flushing, NY, Medical Examination Publishing Company, Inc., 1975. \$8.00

Atlas of Human Anatomy, Johannes Sobotta and Frank H.J. Figge, eds. 3 Volume set (Volume 1: 275 pp, illustrated; Volume 2: 247 pp, illustrated.) Baltimore-Munich, Urban & Schwarzenberg, 1974, reprinted 1977. \$92.50

Atlas of Abdonimal Ultrasonography in Children, Gary F. Gates. 283 pp, illustrated. New York, Churchill Livingston, 1978. \$27.50

Textbook of Nuclear Medicine: Basic Science, Antonio Fernando Goncalves Rocha and John Charles Harbert. 412 pp, illustrated. Philadelphia, Lea & Febiger, 1978. \$27.50

Physicians' Desk Reference for Radiology and Nuclear Medicine, 1978-79, M. Donald Blaufox and Leonard M. Freeman, editorial consultants. 202 pp, illustrated. Oradell, New Jersey, Medical Economics Company, 1978. \$12.00

Radiobiology for the Radiologist, 2nd ed., Eric J. Hall. Hagerstown, Maryland, Harper & Row, Publishers, Inc., 1978. \$25.00

Nuclear Radiology (Second Series) Syllabus, Barry A. Siegel, Naomi P. Alazraki, Philip O. Alderson, R. Barry Grove, Paul B. Hoffer, and Barbara J. McNeil, with nine contributors. 640 pp, illustrated. Chicago, Illinois, American College of Radiology, 1978.

PACIFIC NORTHWEST CHAPTER ANNUAL SPRING MEETING

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