ABSTRACTS OF CURRENT LITERATURE

Pre- and Intraoperative Volume Determination of Craniopharyngioma Cysts. P. Georgi, L. Strauss, V. Sturm, H. Ostertag, H. Sinn T. Rommel; Heidelberg, Germany. *Nucl.-Med* 19: 187–190, 1980

Craniopharyngioma therapy with Y-90 requires knowledge of the volume of the cyst. The authors compared results obtained by computed tomography with those from the radionuclide dilution technique. Nine patients between 9 and 62 years old were examined. The computer tomograph achieved a 3 mm resolution. Cystic volume was determined from serial tomographic cuts. Following stereotactic puncture of the cyst, 2 ml of fluid were drawn and exchanged for 2 ml of saline containing 5 mCi Tc-99m human serum albumin (Tc-99m HSA). Cystic content was mixed with the radioisotope by repeated aspiration into the syringe and return of the fluid into the cyst. After mixing, the cystic contents were drawn and radioactivity measured for volume determination. Y-90 instillation followed with the dose calculated so that the radiation to the cyst wall was 20,000 rad. The authors found a close correlation between the volume determination obtained with CT and with the isotope dilution technique. In two studies divergent results were found, one probably due to presence of a chambered cyst. Gamma camera scintigrams at 2-3 hr after instillation of Y-90 demonstrated the distribution of both radionuclides within the cysts. The authors point out that dual-volume determinations are valuable, since tomography may fail to identify the existence of chambered cysts. Postinstillation scintigrams appear helpful since tracer escape can be identified.

Combined Radionuclide Circulation and Static Imaging of the Brain. Space-Occupying Lesions. V. Kempi, B. Ritter, C. von Schéele; Östersund, Sweden. Nucl.-Med. 19: 120-126, 1980

The authors present a retrospective study of 398 patients suspected of having mass lesions in which they compared the value of Tc-99m perfusion scintigraphy with static images of the brain. Following i.v. injection of 15 mCi of ^{99m}TcO₄⁻ 2-sec sequential scintigrams were recorded for 60 sec with a gamma camera interfaced to a minicomputer. A high-resolution, parallel-hole collimator was used. Static images in four projections were made 90 min after the flow study. Each scintigram contained the counts gathered during a 5-min interval. Images and flow-curves were evaluated visually. Examinations were obtained in 83 patients with a demonstrated space-occupying lesion. Of these, nine had metastatic disease that failed to be detected once, was seen with both procedures five times, and with only one of the methods three times. Twenty-nine patients had astrocytoma. The static scintigrams demonstrated 83%, and the perfusion study only 50%, of the lesions. Meningiomata were seen 12 times, but of these only eight patients had a positive flow study, and 11 a positive scintigram. Of the 25 patients who presented with subdural hematoma, an abnormal flow pattern was seen in 16 examinations, whereas nine had normal perfusion studies. Of the 25 static scintigrams, 22 were positive. Eight less commonly seen space-occupying lesions were grouped, and five of these had a positive perfusion scintigram, while seven were identified in the equilibrium scan. In patients clinically classified as having nonfocal disease, 315 examinations were performed. Appropriate supportive studies were not presented to support the clinical diagnosis in these patients, and flow curves failed to give information not seen by visual inspection of the flow images. The combined imaging procedure revealed pathology in 55% of proven space-occupying lesions, 4% of the lesions were seen in the flow-study only, and 28% of the lesions were seen only on the static scintigrams.

The Heart Is a Target Organ for Androgen. H. C. McGill, Jr, V. C. Anselmo, J. M. Buchanan, P. J. Sheridan; Texas Health Science Center & Southwest Foundation for Research. *Science* 207: 775–777, 1980

In an attempt to unravel the sex differences in heart disease, the authors have used autoradiography to demonstrate the localication of 5α -dihydro(1,2,4,5,6,7-³H) testosterone. Three female baboons and three rhesus monkeys were prepared by ovariectomy and adrenalectomy for testosterone injection. One animal of each species got 100 times as much unlabeled hormone for the study of saturation effects. One hour after injection the animals were killed and tissue samples prepared for autoradiography. The autoradiograms show intense activity concentrated in the nuclei of the ventricular and atrial myocardial cells. The effect was saturable as high testosterone concentration. Tritiated testosterone and $(17\alpha$ methyl-³H) trienolone were also mixed with cardiac tissue cytosol in vitro to test for androgen receptors. Scatchard plots of the data yielded dissociation constants in the range of $2 \times 10^{-9} M$. Several androgens were ranked according to their dissociation constants 17β -estradiol competed for binding to a limited extent whereas diethylstilbesterol, estrone, estriol, progesterone, and cortisol showed no competition. Past research in this area has focused on the presence of estrogens in women as a protective factor, but perhaps the focus should be on the androgens in men and its effects.

Bronchiectasis in Childhood. Comparison of Chest Roentgenograms, Bronchography and Lung Scintigraphy. J. Vandevivere, M. Spehl, I. Dab, D. Baran; Brussels. *Pediatric Radiol* 9: 193–197, 1980

As screening procedures the reliability of lung scintigraphy and chest radiography to select patients requiring bronchography was evaluated in 76 children (ages, from 6 mo to 15 yr) (102 unilateral bronchograms) thought possibly to have bronchiectasis. The studies were performed 3-6 mo after the last pulmonary infection and immediately after physiotherapy for bronchial drainage. Perfusion scans (four views) were performed using Tc-99m-labeled MAA or HAM and ventilation scans were made with Kr-81m. The lung scintigram was considered abnormal when a defect was present. Chest radiographs were considered abnormal if there were direct or indirect signs of bronchiectasis. The presence of bronchiectasis was demonstrated by bronchography in 26 lungs of the 102 studied. Chest radiographs showed changes suggesting bronchiectasis in 19 of the 26, but also in 18 of 76 lungs without bronchiectasis (sensitivity 73%, specificity 76%). Scintigrams showed defects corresponding to areas of bronchiectasis in 24 of the 26 cases, but defects also existed in 30 of the 76 lungs without bronchiectasis (sensitivity 92%, specificity 60%). Where chest radiography and scintigraphy were taken together, sensitivity

reached 96% and bronchiectasis was excluded in 40 of 41 lungs when both studies showed no abnormality. On this basis, bronchography could have been avoided in 40% of the patients studied.

Modern Concepts of Imaging of the Pancreas. J. F. Simeone, J. Wittenberg, J. T. Ferrucci, Jr.; Massachusetts General Hospital and Harvard Medical School. *Invest Radiol* 15: 6–8, 1980

Pancreatic imaging is an area fraught with changing methods and new possibilities. In this review, the authors have examined the various techniques available. They have developed an algorithm that includes consideration of (a) the likelihood of a technically adequate examination, (b) predictability of lesion size, (c) potential for histologic diagnosis by biopsy, and (d) potential examination morbidity. The modalities most often suggested for the initial study are ultrasound and computed body tomography, with endoscopic retrograde cholopancreatography, angiography, percutaneous transhepatic cholangiography and upper GI series resorted to in special circumstances. Pancreatic scanning with [⁷⁵Se] selenomethionine was mentioned, but the newer hepatobiliary agents were not considered.

Renal Allograft Rejection: Sonography and Scintigraphy. A. Singh, W. Cohen; Suny Upstate Medical Center, Syracuse, NY. Am J Roentgenol 135: 73–79, 1980

A retrospective study was made of thirty renal allograph recipients who had undergone episodes of rejection. The diagnosis was based upon clinical and laboratory observations (14 cases) and renal biopsy or nephrectomy specimens (16 cases). Sixty-nine sonographic studies and 288 radionuclide studies, which included flow studies utilizing an i.v. bolus injection of Tc-99m glucoheptonate or Tc-99m DTPA and imaging with a gamma scintillation camera as well as sequential imaging with I-131-labeled orthoiodohippurate, were analyzed.

In 28 of 29 episodes of severe rejection, parenchymal zones of decreased echogenicity were present as compared with similar findings in ten of 25 instances of mild rejection. Similar findings were not observed during episodes of acute tubular necrosis (ATN). The finding of changes in demarcation of the corticomedullary junction was less helpful. Increased renal size was appreciated in 19 of 20 patients undergoing rejection.

All patients undergoing rejection or ATN demonstrated scintigraphic abnormalities. In addition, findings consistent with the rejection phenomona were present in patients with normal sonograms and mild rejection episodes. A decrease in perfusion and function was observed in transplant rejection and severe ATN. Only a decrease in function was seen with milder forms of ATN. Serial scintigraphic studies for the detection of rejection manifested by subtle changes in the study, although very helpful, may leave small changes undetected in the face of pre-existing rejection or severe ATN.

"Stasis—A Test for Vesico-ureteric Orifice Competence in Children With Reflux. J. E. Pollet, P. F. Sharp, F. W. Smith; Univ. of Aberdeen, Aberdeen, Scotland. *Pediatric Radiol* 9: 213–215, 1980

Fifty-eight children were studied by micturating cystography, cystoscopy, and intravenous radionuclide cystography (IVRNC) for evaluation of the competency of the ureteric orifices. Technetium-99m DTPA in a dose of from 150 to 200 μ Ci per kg body weight was administered intravenously and 20-sec static images were collected sequentially from the time of injection and for 20 min thereafter, with data storage in a computer. About 15 min

after the renogram phase of the study was completed and ideally after most of the tracer was excreted in the bladder, 5-sec sequential images of the urinary tract were obtained before, during, and after micturation and computer stored for later analysis. Retained radioactivity in a kidney with a sudden decrease in activity in that kidney upon micturation was considered abnormal and termed "stasis." The IVRNC study results were compared with the findings at cystoscopy. Thirty-eight instances of "stasis" were observed, 29 (76.3%) of which were accompanied by the findings of an abnormal ureteral-vesico orifice at cystoscopy. Ten patients (12.8%) had abnormal cystoscopic findings but no "stasis."

Tumor Localization of Radiolabeled Antibodies Against Carcinoembryonic Antigen in Patients with Carcinoma: A Critical Evaluation. J.-P. Mach, S. Carrel, M. Forni, J. Ritschard, A. Donath; Lusanne. N Engl J Med 303: 5–10, 1980

The specificity of tumor localization by scintiscanning using I-131-labeled anti-CEA antibodies was investigated in 27 patients with colorectal carcinoma. The first 24 patients received injections of 1 mg of purified goat anti-CEA antibodies labeled with 1 mCi of I-131, and patients 25-27 received 0.5 mg of F(ab')2 fragments from the same antibodies labeled with 1 mCi of I-131. All patients were tested for hypersensitivity to normal goat IgG, and all were pretreated with Lugol's, promethazine, and prednisolone before injection of the radioactive antibodies. Subtraction of blood-pool radioactivity and free-isotope radioactivity from mucosal secretion was accomplished by injection of 500 μ Ci of Tc-99m-labeled human serum albumin and 500 µCi of Tc-99m-labeled pertechnetate. Eleven patients had positive scans, eight had equivocal scans and eight had negative scans. Eight patients with positive scans had their tumors resected within 8 days following the photoscans. The average concentration of antibody radioactivity in the tumor was found to be 3.6 times higher than in adjacent normal colon mucosa, 4.5 times higher than in external normal bowel wall, and 8.0 times higher than in normal fatty tissue. Four of these patients received simultaneous injections of 1 mg of normal goat IgG labeled with 200 μ Ci of I-125. The labeled normal goat IgG had an almost equal distribution in tumor and normal tissue. This method of tumor immunodetection is not currently recommended for clinical use, but improvement of subtraction techniques as well as the use of different antibody fragments or monoclonal antibodies may render this method more sensitive and reliable.

Effect of Different ⁹⁰Sr Doses on the Microscopic Structure of Foetal Mouse Ovaries. C. Rönnbäck; Umeå, Sweden. Acta Radiol Oncol 19: 145–152, 1980

The study sought to determine the minimum amount of Sr-90 required to result in microscopically noticeable reduction of oocytes and follicles in fetal ovaries of mice. On the basis of the amount of radioisotope injected, seven groups were formed, each of which received from 0.3 to 10 µCi Sr-90. Two groups of animals served as controls. The tracer was given as carrier-free Sr-90 nitrate in 1 N nitric acid diluted in saline. Radioisotope injection was on the 19th day of pregnancy, and animals were sacrificed on Days 28, 56, and 84 postpartum for histological analyses of their ovarian content. The left ovary of every female was serially sectioned with a thickness of 5 μ m, and every 10th section was examined. The cell material was placed into one of seven groups depending on the stage of ovarian development. Furthermore, degenerated stages were counted and placed into two separate groups. The frequency of the various cell lypes in the nine groups was adjusted to give the approximate number of cells in the whole ovary. The author found the total number of cells per ovary to decrease with increasing radioisotope application. Each group of mice that had received

Sr-90 had a significant reduction of cells in each stage of ovarian development when compared with controls. A decrease in naked oocytes, to 50% of control values, was seen in animals whose mothers received only 0.3 μ Ci Sr-90. This observation was made at both Days 28 and 56. Radiostrontium injection of 0.6 μ Ci resulted in greater reduction of naked oocytes, and more advanced oocyte stages were affected as well. With 10 μ Ci Sr-90 naked oocytes were eliminated and only 3% of advanced oocytes, with a nearly complete cell layer, remained. The author concludes that even 0.3 μ Ci Sr-90 given to pregnant female mice results in significant injury to fetal ovaries.

Determination of Red Cell Survival in Rabbits by Fluorescent Excitation Analysis of Stable Rubidium. R. Cesareo, M. G. Ciancarelli, E. Scarnati. *Med Phys* 7: 97–100, 1980

Chromium-51-labeled red cells have been used for over 20 yr as a radioactive tracer to label red cells despite the fact that it is known to elute from red cells and is a toxic element. If red cells could be labeled with a stable tracer, significant advantages would result. Stable rubidium chloride was used to label red cells of rabbits in vitro. The labeled red cells were injected, and weekly blood samples analyzed by fluorescent excitation analysis to determine red cell survival times. Analysis for rubidium was performed by excitation with Cd-109 source detection with a Xe-filled proportional detector and readout with a single channel analyzer. Results were compared with a control study with Cr-51-labeled cells, readout with fluorescent excitation method, and with the usual counting of the 320 keV x-ray. The results were promising, based on tests with three rabbits. The authors conclude that this method might be able to replace Cr-51 determinations of red cell survival with further improvement.

Bone Scanning of the Thoracic Spine—Report of a Case. J. A. Sevastikoglou, Saaro, E. Elmstedt, M. Dahlborn; Huddinge Univ. Hosp., Huddinge, Sweden. *Clin Orthop Rel Res* 149: 172–175, 1980

Five girls recently diagnosed as having idiopathic progressive thoracic scoliosis were studied by bone scanning of the vertebrae and ribs following the intravenous administration of 0.07 mCi/kg body weight of Tc-99m MPD. In the posterior view, allowing for the normal increase of tracer uptake at the costovertebral junction, uniform uptake of tracer was observed within the vertebrae in each case. In the frontal view of four of the patients, costocondral uptake of isotope was greater in the ribs of the concave side than on the convex side of the spinal curvature. In the fifth case, the opposite was true. Though preliminary in nature, the findings suggest that a disturbance in vertebral growth *per se* may not be fundamental to the development of progressive idiopathic thoracic scoliosis and may be the result of other forces acting upon the spine.

On the Potential Use of Stimulated Positron Emission (SPE) in the Detection and Monitoring of Some Bone Diseases. M. Benjamin, A. Macovski. *Med Phys* 7: 112–119, 1980

A new method to measure regional loss of bone tissue was investigated. High-energy, collimated photons irradiate a section of bone to be analyzed resulting in pair production. The subsequent annihilation quanta can be counted and imaged with coincidence counting techniques. This process is mathematically modeled by the authors, and a quantitative understanding of the method is presented. Although this method cannot quantify the absolute amount of bone, it can measure the loss of bone in follow up of a single individual over the course of disease and therapy. For cortical bone 5% changes can be detected with 0.5 rad or less. Vertebral bone would require 2-5 rads for 5-10% precision. Increased dose would result in a corresponding increase in precision. If an imaging mode is used, the authors predict a reduction in the dose by a factor of four to achieve 5-10% precision.

Particle-Induced X-Ray Emission (PIXE) Analysis of Biological Materials: Precision, Accuracy and Application to Cancer Tissues. W. Maenhaut, L. DeReu, H. A. Van Rinsvelt, J. Cafmeyer, P. Van Espen. Nucl Inst Meth 168: 557–562, 1980

The precision and accuracy of PIXE for determination of microgram quantities of 15 elements was investigated and compared with neutron activation analysis (NAA). A proton beam of 2.4 MeV was used for this work and was supplied by a compact isochronous cyclotron. A Si(Li) solid state detector was used for sample counting. Relative standard deviation varies from 6-16% for the various elements, except when counting statistics were poor. In general there was good agreement between known sample values and measured values with both PIXE and NAA; however, potassium and rubidium were exceptions. Cancer tissues and normal tissues were examined for trace element concentration ratios with zinc as the reference element. Striking differences were obtained when results from cancer tissues and normal tissues were compared. Major differences were found for cadmium, potassium, iron, bromine, and rubidium ratios. The authors state that more work is needed to clarify the meaning of the ratio changes. The PIXE method itself may provide an important tool for these studies.

Biomedical Application of PIXE at the University of Liege. G. Weber, G. Robaye, J. M. Delbrouck, I. Roelandts, O. Dideberg, P. Bartsch, M. C. DePauw. *Nucl Inst Meth* 168: 551–556, 1980

Charged Particle Induced X-ray Emission (PIXE) promises to be a unique method to perform trace analysis of biomedical, environmental, and metallurgical samples. In this paper the authors present results of their studies with an isochronous cyclotron using a 3 MeV proton beam. One-hundred-milligram quantities of the sample (in this case, proteins, anti-tumor drug, and lung tissue) were analyzed after irradiation with the beam in a high-resolution, intrinsic, germanium detector system. The elements detected were iron, copper, zinc, bromine, nickel, cobalt, lead, and gold. Precision for most elements is better than 10%, however, the technique can detect many more elements than these. The indicated results confirm that quantitative elemental analysis in very small samples can be performed with modest cyclotron and detector requirements.

Elemental Analysis by Means of X-Ray Attenuation Measurements. R. Cesareo, M. Giannini. *Nucl Inst Meth* 169: 551–555, 1980

The interest in attenuation measurements at various energies for biological tissues has been spurred by the rapid growth of computed tomography. This paper reports on the attenuation coefficient of materials of biological interest with Cd-109, Am-241, and Co-57 monoenergetic gamma photons. Measurements were made with narrow beam geometry using a NaI(Tl) detector. Linear attenuation coefficients were tabulated for plasma, urine, water, whole blood, red blood cells, nylon, Teflon, Plexiglas, polyethylene, and bachelite. The accuracy of the measurements was between 0.5 and 1%. A discussion follows in which the authors propose the use of elemental analysis to obtain the composition of materials using attenuation measurements.

Random Summing in a Multidetector Counting System Measuring Mixtures of Radionuclides of Short and Long Half Lives. B. Okroyd,

S. G. Graham. Nucl Inst Meth 167: 489-498, 1979

In whole-body counters the range of activities and therefore the range of count rates vary over several orders of magnitude and sometimes occurs during a single experiment. At the higher count rates several distortions of the data occur including random summing. In some instances mixtures of radioisotopes exist, some of which have short half-lives compared with the counting time. Count rate effects are thus variable over the duration of the experiment. The authors describe a method to correct the data for the random summing. The method requires a knowledge of the live-time error, blocking losses, variation of resolving time with energy, a standard spectrum for each radionuclide of the mixture and their fraction in the mixture, the decay constant of each radionuclide, and the fraction of the total events recorded by the system. Equations are presented to determine the correction factors.

Cholestatic Syndromes in Infancy and Childhood. G. F. Gates, F. R. Sinatra, D. W. Thomas; Children's Hospital, Los Angeles, CA. *Am J Roentgenol* 134: 1141–1148, 1980

In a series of 33 children with various cholestatic syndromes, sonography identified abnormalities in 17 of 19 with extrahepatic cholestasis and proved normal in all 14 patients with intrahepatic causes of cholestasis. Iodine-131 rose bengal scintigraphy was useful when bowel visualization occurred confirming biliary patency. In the absence of visualization, this modality could not separate extra- from intrahepatic cholestasis. A spectrum of pathologic entities is presented, including choledochal cyst, cholelithiasis, biliary atresia, and obstruction of the biliary tract by a lymphomatous mass. Technetium-99m sulphur colloid scintigraphy proved less useful than either ultrasound or rose bengal studies. The authors recommend ultrasonography as the initial screening study in the jaundiced patient. Representative ultrasonograms and scintigrams are provided.

Floating Galistones: The Role of Contrast Material. G. A. Scheske, P. L. Cooperberg, M. M. Cohen, H. J. Burhenne; Vancouver General Hospital, Vancouver, British Columbia, Canada. *J Clin Ultrasound* 8: 227–232, 1980

Of 400 patients with gallstones, floating calculi were found in only three patients, and in each of these cases the patient had undergone cholecystography recently. Floating gallstones were never found in patients who had not undergone a recent oral cholecystogram. The inference supports previous reports that gallstones float only in the presence of contrast material, which serves to increase the specific gravity of the bile. In vitro studies were used to corroborate the in vivo findings. The authors caution that in the patient in whom oral contrast has been administered, gallstones may appear in nondependent positions on the ultrasound examination. High Resolution Real-Time Sonography of Hemodialysis Vascular Access Complications. W. Scheible, C. Skram, G. R. Leopold; University Hospital, San Diego, Ca. Am J Roentgenol 134: 1173–1176, 1980

Varying a mechanically driven 10 MHz transducer device that produces a 3×4 cm rectangular image, the authors studied a variety of complications associated with surgically created dialysis shunts. Both stenosis and thrombosis, which are common complications of access routes, were better evaluated by ultrasound than angiography since the length of both the stenotic segments or occluding thrombus could be assessed better by this method. Aneurysm, pseudoaneurysm, wall irregularities, and infection were also identified sonographically. Such information can also be obtained by conventional contact scanning with 5 MHz transducers, but it involves considerably more laborious and painstaking techniques than with the presently described instrumentation. The authors suggest that the integration of high-resolution, real-time systems with Doppler instruments would ultimately prove the most useful approach to hemodialysis access routes.

Fetal Ascites not Associated with Rh Incompatibility: Recognition and Management with Sonography. F. P. Hadlock, R. L. Deter, J. Garcia-Pratt, P. Athey, R. Carpenter, C. M. Hunkley, S. K. Park; Jefferson Davis Hospital, Houston, TX. Am J Roentgenol 134: 1225–1230, 1980

The major causes of fetal ascites are assumed to be caused by Rh incompatibility, intestinal anomalies with secondary perforation, porta-hepatic abnormalities, and genitourinary abnormalities. In a study of ten cases of fetal ascites identified in utero and not associated with Rh incompatibility the authors found 60% were secondary to developmental anomalies of the genitourinary system and/or gastrointestinal system. Urethral obstruction and/or anal atresia were most frequently responsible. Intestinal lymphangiectasia, ureteral stenosis, absent genitalia with anal atresia, and congenital syphillis were among the other causes identified. In the presence of fetal ascites, specific causes should be sought sonographically and the neonatologist advised of an impending problem. Minimal ascites is differentiated from pseudoascites by clinical and sonographic follow-up.

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