

ABSTRACTS OF CURRENT LITERATURE

Radiolabeled Peanut Lectin: A Potential Radiopharmaceutical for Immunodetection of Carcinoma Expressing the T Antigen. P. L. Zabel, A. A. Noujaim, A. Shysh, J. Bray; Faculty of Pharmacy and Pharmaceutical Sciences, Edmonton, Alberta T6G2N8, Canada. *Eur J Nucl Med* 8:250-254, 1983

Peanut lectin (PNA), a carbohydrate binding glycoprotein, was investigated in an animal study as a potential tumor localizing agent. PNA was labeled with iodine-125 and injected in male CBA/CAJ mice bearing RI-lymphoma. Six to ten mice were killed for each sampling interval (3, 8, 24, and 48 hr following radionuclide injection). A rapid, whole-body elimination (whole-body activity 1.4% after 48 hr) and blood clearance (1.8% of the remaining activity in the blood after 48 hr) was observed. The average tumor-to-muscle ratios raised from 13:1 at 3 hr to 40:1 after 48 hr. Tumor-to-blood ratios also increased from 6:1 at 24 hr to 17:1 after 48 hr. Kidney, stomach, and salivary glands were visualized due to the *in vivo* breakdown of I-125 PNA. Thus other radionuclides, such as In-111, should be investigated for future use.

The Use of Radionuclide Retinal Scintigraphy for the Assessment of Retinopathy in Diabetes Mellitus. M. L. Freeman, W. E. Barnes, L. S. Evans, A. Kelertas, E. Kaplan, J. E. McDonald; Veterans Administration Hosp., Hines, IL. *Ophthalmology* 90:513-516, 1983

Vitreous fluorophotometry has been used to assess the development of diabetic retinopathy, but it is available in relatively few institutions. Based on analogy with the use of Tc-99m DTPA to detect breakdown of the blood-brain barrier, this commonly available radiopharmaceutical was investigated for detection of altered blood-retinal barrier. A group of 40 diabetic patients were divided into four groups: Group I, those without diabetic retinopathy; Group II, those with background retinopathy; Group III, those with proliferative retinopathy; and Group IV, those with endstage eye disease. Nondiabetic patients ($n = 10$, age 27-65) referred for brain scans acted as controls. Retinal scintigraphy was performed 2 hr after the *i.v.* injection of 20 mCi Tc-99m DTPA. Standard head views plus a modified Waters view were taken, and the raw data were processed by on-line digital computer. Regions of interest were taken to include each orbit and compared with an area of nonorbital brain for calculation of eye-to-brain ratios. Ratios of the two eyes were averaged except in monocular patients. Diabetics with proliferative retinopathy had higher means ratios than any of the other groups ($p < 0.025$ for Groups I and II; $p < 0.075$ for Group IV). No significant differences were found among patients of Groups I, II, and IV. Since there is great interpatient variability, the test probably will be most useful as a follow-up for the course of disease with each patient serving as his own control.

Malignant Lymphoma and the Thyroid Gland. W. Becker, H. A. Müller, C. Reiners, P. H. Wunsch, R. Schäffer, U. Gunzer, W. Börner; Department of Nuclear Medicine, University of Würzburg, D-8700 Würzburg, Federal Republic of Germany. *Tumor Diagnostik* 4:55-62, 1983

A retrospective analysis of 4325 goiter patients was performed. Twenty-nine patients had histologically verified non-Hodgkin's

lymphoma and eight patients suffered from Hodgkin's lymphoma. Five of the patients with non-Hodgkin's disease were classified as primary lymphoma of the thyroid gland. In five other patients, secondary lymphoma of the enlarged thyroid gland was diagnosed. All patients with primary lymphoma of the thyroid had a photopenic nodule in the scintigram and were euthyroid. Ultrasound examinations demonstrated liquid structures within the photopenic nodules. Ga-67 citrate images revealed no evidence of extrathyroid lymphoma in three patients with primary lymphoma. One patient had Ga-67 citrate accumulation in the thyroid. No infiltration of the thyroid was observed in the patients with Hodgkin's disease. Autoantibodies and thyroglobulin levels were within the normal range. In 13 patients an anaplastic carcinoma was verified. The ultrasound appearance of the carcinomas was mixed with hypoechogenic, liquid, and solid hypoechogenic structures. Since the clinical appearance of anaplastic carcinomas and primary lymphoma were similar, the differentiation was only possible on the basis of fine needle biopsy.

Radiation Risk of Thyroid Scintigraphy in Newborns. H. Beekhuis, D. A. Piers; Department of Nuclear Medicine, University Hospital, Groningen, The Netherlands. *Eur J Nucl Med* 8:348-350, 1983

The radiation risk of thyroid scintigraphy with [^{99m}Tc]pertechnetate, I-125, and I-131 in newborns with suspected congenital hypothyroidism was estimated. Assuming normal thyroid function, the total body radiation dose was seven times higher for I-125 than for Tc-99m. In patients with congenital hypothyroidism, the thyroid uptake is reduced. Therefore, the thyroid radiation dose is lower than in normals. The probability for thyroid malignancy induction after scintigraphy is 3×10^{-6} for Tc-99m, 2×10^{-5} for I-123, and 9×10^{-4} for I-131. The probability of any malignancy in newborns with suspected congenital hypothyroidism is 1.4×10^{-5} for Tc-99m, 3×10^{-5} for I-125, and 2×10^{-3} for I-131. The authors conclude that Tc-99m or I-123 iodine should be used for thyroid scintigraphy, since neither radionuclide considerably increases the spontaneous tumor frequency. I-123 should be preferred because of the higher specific uptake and the possible detection of organification defect.

Use of Adjunctive Potassium Iodide after Radioactive Iodine (I-131) Treatment of Graves' Hyperthyroidism. D. S. Ross, G. H. Daniels, P. DeStefano, F. Maloof, E. C. Ridgway; Massachusetts Gen. Hosp., Boston, MA. *J Clin Endocrinol Metab* 57:250-253, 1983

The usefulness of adjunctive potassium iodide (KI) therapy in the treatment of Graves' disease with I-131 was assessed retrospectively in a review of 119 patients treated over a 13-yr period. All patients had classic clinical findings of Graves' disease, none had undergone any previous treatment, and none received estrogen-containing medications or antithyroid drugs after treatment. The adjunctive KI therapy consisted of 2-10 drops (5.0 ± 1.5 drops; ~ 250 mg) of KI (saturated solution), beginning 1 wk after I-131 and continued until the patient became asymptomatic (5-28 wk). I-131 dosage was determined by the formula, $80 \mu\text{Ci/gm} \times$ estimated weight of thyroid $\times 100/\text{RAIU}$. Hyperthyroidism was defined as a serum T₄ concentration of $< 4 \mu\text{g/dl}$ and/or serum TSH $3.5 \mu\text{U/ml}$. A single dose of I-131 was successful in 100 patients, 49 of whom received I-131 alone and 51 of whom were

treated with I-131 + KI. There were no significant differences in the pretreatment clinical findings between the two groups. Mean serum T_4 concentrations were significantly lower 7 wk after treatment in the group receiving adjunctive KI therapy: 8.0 ± 3.9 $\mu\text{g}/\text{dl}$ compared with 12.3 ± 6.1 $\mu\text{g}/\text{dl}$ in those treated with I-131 alone ($p < 0.001$). Transient hypothyroidism was common in patients treated with I-131 and KI. The incidence of hypothyroidism after 1 yr was 58% in both groups (30/52 after I-131 alone and 32/55 after I-131 and KI). These data demonstrate more rapid chemical response in patients treated with I-131 and KI, and the incidence of symptomatic transient hypothyroidism could probably be lessened by discontinuing KI when T_4 levels or gland size return to normal.

Effect of Fasting and Parenteral Alimentation on PIPIDA Scintigraphy. T. Potter, C. J. McClain, R. B. Shafer; Univ. of Kentucky College of Med., Lexington, KY. *Dig Dis Sci* 28:687-691, 1983

These authors prospectively evaluated ten patients without known acute hepatobiliary disease over the period September, 1981, to January, 1982. Four patients were receiving total parenteral nutrition (TPN) from 36 hr to 10 days, and six were in the fasting state from 2 to 5 days. Each patient received 4 mCi Tc-99m PIPIDA i.v. and was imaged by gamma camera in supine position at 5, 10, 15, 30, 60, and 120 min. Right lateral views were obtained if the gallbladder visualized. Patients with nonvisualization of the gallbladder were reimaged at 24 hr. Three of the ten patients had nonvisualization of the gallbladder. Patient 1, a 62 yr-old-male, had been on TPN for 6 days at time of scintimaging. Ultrasound of the gallbladder revealed no abnormalities. Clinical course showed steady improvement. A repeat Tc-99m PIPIDA image 6 wk later after oral food intake had been resumed showed normal gallbladder visualization. Patient 2, a 34-yr-old male, had received TPN for 4 days at time of scintimaging. Abnormal TCT scan done 2 days later showed normal gallbladder and biliary ducts. Repeat Tc-99m PIPIDA study done 6 wk after discontinuation of TPN and resumption of oral food intake revealed normal visualization of the gallbladder. Patient 3, a 49-yr-old male, had been fasting 48 hr at time of scintimaging. Ultrasound examination showed a normal gallbladder with normal wall thickness and normal ductal system. Scintigraphy and oral cholecystography performed 6 wk after discharge from hospital were both normal. The authors present several hypotheses for the mechanism of gallbladder nonvisualization in Tc-99m PIPIDA imaging. They conclude that clinicians should be aware that hepatobiliary imaging in patients fasting or receiving total parenteral nutrition may yield false-positive results.

^{67}Ga Lung Scans in Progressive Systemic Sclerosis. M. Baron, D. Feiglin, R. Hyland, M.D. Urowitz, B. Shiff; Jewish Gen. Hosp. Montreal, Quebec, H3T1E2, Canada. *Arthritis Rheum* 26:969-974, 1983

Awareness of the early pulmonary lesion in a patient with progressive systemic sclerosis (scleroderma) is an important factor for treatment of the disease. To develop diagnostic criteria, 19 patients with scleroderma were studied by quantitative Ga-67 lung study. All studies were performed 48 hr after 6 mCi citrate i.v. injection. Results were expressed quantitatively as the Ga-67 Uptake Index. The mean total pulmonary Ga-67 Uptake Index in these patients was significantly higher than in controls (41 compared with 25), and four patients fell outside the normal range. There were no clinical or laboratory variables that correlated with the Ga-67 uptake. The explanation for the increased Ga-67 uptake in these patients is related to increased inflammatory cell infiltrations that may resemble idiopathic pulmonary fibrosis in a patient. The authors concluded that increased pulmonary Ga-67 uptake in scleroderma may prove useful as an index of pulmonary disease activity.

The Role of Hepatobiliary Scintigraphy in Differentiating Acute Cholecystitis from Acute Nonbiliary Pancreatitis. W. Al-Sheikh, A. Serafini, J. Barkin, G. Spoliansky, M. Hourani; Univ. Miami School Med., Miami, FL. *Am J Gastroenterol* 78:502-506, 1983

To differentiate acute nonbiliary pancreatitis from acute cholecystitis, 35 patients with acute nonbiliary pancreatitis were studied using injections of 5 mCi of Tc-PIPIDA for hepatobiliary imaging. The images were obtained at 5, 10, 15, and 30 min and then at 30 min intervals up to 2 hr. Delayed and oblique images were obtained when indicated. A scintigram was considered normal if both gallbladder and bowel activity were seen in 1 hr. A study was considered abnormal if there was (1) delayed visualization of the gallbladder, (2) delayed or nonvisualization of activity in the bowel, (3) combination of 1 and 2. Of those patients with acute nonbiliary pancreatitis, 28 of 31 (90.3%) had the gallbladder visualized in 1 hr, three of 31 (9.7%) had delayed visualization of gallbladder, and no patient in this category failed to have visualization of the gallbladder. In two of four patients with acute episodes of pancreatitis superimposed on chronic pancreatitis, the gallbladder was visualized. Therefore, the authors concluded that the hepatobiliary scintigraphy remains a valuable test to differentiate acute nonbiliary pancreatitis from acute cholecystitis.

Autonomic Modulation of Bronchoconstriction After Pulmonary Microembolism in Guinea Pigs. T. P. Clay, J. M. B. Hughes; Departments of Radiology and Medicine, Hammersmith Hospital, London W12 0HS, United Kingdom. *Lung* 161:275-285, 1983

Pulmonary microembolism produces peripheral airway and alveolar constriction as shown by a decrease in lung compliance and increase in respiratory resistance. The respiratory resistance was measured in nine guinea pigs before and after pulmonary microembolism through i.v. injection of barium sulfate. One minute after lung embolism an increase (6%, not statistically significant) of the respiratory resistance was observed after embolism. Following bilateral cervical vagotomy, however, a 30% increase in respiratory resistance was obtained. To investigate the influence of β -blocking, propranolol (1 mg/kg) was injected before injection producing embolism. Compared to vagally intact animals, the use of propranolol led to an 24% increase in respiratory resistance. An additional increase of 36% was observed in animals treated with propranolol after lung embolism. Propranolol did not potentiate the airway constriction caused by embolism in vagotomized animals, since the magnitude of the postembolic bronchoconstriction was of the same order as vagotomized animals without propranolol treatment. These results indicate that the bronchoconstricting effect of microembolism, which is initiated by humoral mechanisms (histamine, prostaglandins, thromboxanes) and/or a neural sympathetic reflex, is moderated by an autonomic bronchodilator reflex.

Positive Gallium-67 Scintigraphy Associated with Pulmonary Embolism. J. M. Brown, A. J. Moreno, I. Weisman, F. J. Baker, T. J. Brown, M. N. Lundy; William Beaumont Army Medical Center, El Paso, TX. *Chest* 84:233-235, 1983

This case report describes a 54-yr-old man admitted to hospital with acute onset of shortness of breath, diaphoresis, and palpitation but without chest pain, cough, chills, or hemoptysis. The patient had been at bed rest for 18 days following pelvic node lymphadenectomy subsequent to diagnosed Stage C adenocarcinoma of the prostate. He had been receiving conjugated estrogen therapy for 10 days before admission. Left nephrectomy had been performed 9 wk earlier for Stage A renal cell carcinoma. Ventilation scintigraphy with 4.7 mCi Xe-133 yielded a normal ventilatory pattern. A perfusion image using 5.9 mCi Tc-99m macroaggregated albumin, however, revealed multiple defects involving the entire left lung except for two segments in the left upper lobe as well as multiple segmental defects in the right lung. The superior segment

of the right lower lobe and the right middle lobe were spared. The interpretation was that there was a high probability for pulmonary embolism. On the fourth hospital day, he developed right-sided pleuritic chest pain that continued. Seven days after onset of the pulmonary embolism, the patient received 5 mCi Ga-67 citrate. Imaging 48 hr later revealed abnormal localization of Ga-67 within the right lower lung field. Chest roentgenogram at this time showed pleural reaction with effusion. Laboratory test results consistently ruled out an infectious process. Repeat ventilation/perfusion scintigraphy 3.5 wk after the initial episode showed marked improvement but with continued perfusion defect in the right lower lung with a matched ventilation defect. A chest roentgenogram at this time showed marked resolution of the pleural effusion and also right lower lobe atelectasis. On repeat Ga-67 scintigraphy, there was resolution of the right lower thorax accumulation. The authors conclude that this case identifies a potential pitfall in use of Ga-67 in the differential diagnosis of pulmonary embolism and pneumonitis.

Physical Conditioning and Left Ventricular Performance in the Elderly—Assessment by Radionuclide Angiography. D. D. Schocken, J. A. Blumenthal, S. Port, P. Hindle, R. E. Coleman; Univ. S. Florida College of Medicine, Tampa, FL. *Am J Cardiol* 52: 359–364, 1983

The beneficial effects of physical conditioning are well documented in the young. However, that normal elderly persons can or cannot achieve training effects by physical conditioning is less uniformly recognized. To test the hypothesis that physical conditioning can be achieved in old persons and produces improvement in exercise-induced decrease in left ventricular ejection fraction (LVEF) observed during normal aging, 24 (18 women, six men) normal elderly persons (≥ 65 yr) were studied before and after a 12-wk program of physical training. All subjects underwent rest and exercise (sitting upright) radionuclide angiography before and after the training program. The subjects achieved cardiovascular training effects as measured by increased functional capacity and decreased double product at one-half the maximum work load attained at the initial stress test. After training, a significant increase occurred in the cardiac index response to exercise and in the augmentation of the end-diastolic volume index produced by exercise. However, the exercise-induced decrease in LVEF (pretraining: 67.1% in rest, 61.5% in stress; posttraining: 71.0% in rest, 64.0% in stress) and increase in LV end-systolic volume index remained unaltered by the training. Authors concluded that the age-associated differences in LV contractile performance remained unchanged although older persons can achieve overall training effects from a program of physical conditioning. Thus, deconditioning is not a significant contributor to the decline in LV contractile performance in the elderly.

The Clinical Validation of Gold-195m: A New Short Half-Life Radiopharmaceutical for Rapid, Sequential First Pass Angiography in Patients. D. S. Dymond, A. T. Elliott, W. Flatman, D. Stone, R. Bett, G. Cuninghame, H. Sims; St. Bartholomew's Hosp., London, EC1A 7BE, England. *J Am Coll Cardiol* 2:85–92, 1983

Fifteen male patients (mean age 57 yr, range 42–66), each received two i.v. bolus injections of 17–20 mCi Au-195m volume of less than 0.5 ml each, (the two radiogold injections being separated by 5 min) for routine first-pass radionuclide angiography. Au-195m (half life 30.5 sec) was eluted from an Hg-195m/Au-195m generator using dilute sodium cyanide solution as eluant. (Technical characteristics of this generator have been described.) Approximately 10 min after the second gold study, another first-pass study was performed using 15 mCi Tc-99m, with the imaging protocol identical to that of the gold studies. Left ventricular ejection fractions (LVEFs) determined by Tc-99m and ranging

from 8–62% correlated well with those assessed by gold ($r = +0.99$). With Tc-99m imaging, LVEFs were $39.6 \pm 16.7\%$ (mean \pm s.d.), whereas with Au-195m imaging, they were $38.6 \pm 17.2\%$. Sequential gold LVEFs in each patient differed by a mean of $0.6 \pm 2.7\%$. When two observers independently evaluated the gold angiograms, interobserver mean difference in LVEF was $2.0 \pm 2.9\%$. There was no consistent error introduced into LVEF computations from gold studies when using observed data rather than data corrected for radioactive decay. In all patients, subjective interpretation of regional wall motion as normal, hypokinetic, or akinetic showed that images from Tc-99m and from Au-195m gave identical results. In a patient having triple-vessel coronary artery disease, wall motion images by Au-195m were made at rest (showing LVEF of 51%), after 3 min of graded upright bicycle exercise (50%), after 6 min of exercise (37%), at peak symptom-limited exercise of 8.5 min (32%), immediately after exercise (37%), and after 2 min of recovery (55%). No immediate or delayed ill effects were noted in any patient receiving two doses of Au-195m for sequential first-pass studies. These authors conclude that availability of Au-195m should advance the applicability of first-pass radionuclide angiography in clinical practice.

Noninvasive Cardiac Evaluation of Patients Receiving Adriamycin-Containing Adjuvant Chemotherapy (FAC) for Stage II or III Breast Cancer. M. K. Ali, A. U. Buzdar, M. S. Ewer, R. S. Cheng, and T. P. Haynie. Univ. Texas M.D. Anderson Hosp., Houston, Texas. *J Surg Oncol* 23:212–216, 1983

The effect of adjuvant combination chemotherapy—fluorouracil, Adriamycin (median dose 300 mg/M²), and cyclophosphamide (FAC)—on cardiac function was assessed in 55 patients (median age 51 yr, range 27–67) with stage II or III breast cancer. All had clinical evaluation and standard 12-lead electrocardiography (ECG) before initiation of chemotherapy and before each subsequent dose. Ejection fractions were determined by M-mode echocardiograms and/or multigated cardiac blood pool imaging before and during therapy in 39 patients and in all patients at the conclusion of chemotherapy. Based on the follow-up course, the patients were subdivided into three groups: Group A (44) remained free of disease for a median follow-up period of 36 mo; Group B (9) developed recurrent disease and were retreated with Adriamycin up to a median combined cumulative dose of 450 mg/M²; and Group C (2) who were treated with a total of 842 and 892 mg/M² of Adriamycin, respectively, and who developed cardiac decompensation. Median values of the QRS voltage and ejection fractions (by ECHO) decreased 11% and 5%, respectively, in Group A and tended to return to baseline promptly. Group B had diseases of 21% and 11%, respectively, at the conclusion of therapy. Decreases were greater in patients who had the added risk factors of radiotherapy and cardiovascular disease. These studies show that prior FAC therapy does not increase the risk of retreatment with Adriamycin and that added risk factors are causes for very close monitoring of cardiac function.

Measurement of the Distributions of Technetium-99m Sulfur Colloid and Technetium-99m HEDP in Normal Humans. L. W. Gossman, V. J. Sodd, H. Nishiyama, P. A. Feller, R. G. Hoops. National Center for Devices and Radiological Health, Cincinnati, OH. *Med Phys* 10:79–82, 1983

Pharmacokinetic data for technetium-99m sulfur colloid and technetium-99m HEDP were obtained for each agent in ten adults referred for a diagnostic imaging procedure. The individuals were judged by a reviewing physician to have medical conditions unlikely to interfere with normal imaging of the radiopharmaceutical. The radiation detection instrument used for this study was a whole-body scanner, which consisted of sixteen NaI(Tl) detectors mounted in a linear array under a patient table. During data accumulation, the detector array was incremented along the long axis

of the patient table, building up a 16- × 100-element array of count densities in a computer medium. The geometric mean of counts from opposing views along with correction for patient thickness was used to quantitate the internal activity detected. The biological distribution data were used to calculate absorbed radiation dose estimates for each agent. Except for that of the kidney in the case of HEDP, these were found to be in agreement with previous estimates, not based on human data. The discrepancy underlines the need for accurate biological data if accurate radiation dose estimates are to be obtained.

Absence of Splenic Uptake of Radiocolloid due to Thorotrast in a Patient with Thorotrast-Induced Cholangiocarcinoma (Case Report). A. K. Burroughs, N. M. Bass, J. Wood, S. Sherlock; Royal Free Hospital and School of Medicine, London. *Br J Rad* 55:598-600, 1982

Thirty-one years after the intraarterial injection of Thorotrast, a 40-yr-old female developed obstructive jaundice from a biliary duct carcinoma at the liver hilum. Abdominal radiographs showed fine reticular opaque shadowing in the liver and a homogeneously radiodense shrunken spleen. Imaging with Tc-99m SC radiocolloid showed a complete absence of splenic uptake, evidence of complete splenic atrophy, and the first documented report of such a case resulting from Thorotrast. An enlarged left hepatic lobe with an irregular filling defect was observed. Ultrasound and retrograde cholangiography showed a high, complete obstruction of the common bile duct, with irregular dilated intrahepatic biliary ducts. At laparotomy a fibrous mass was found surrounding the common bile duct, and a biopsy confirmed biliary duct carcinoma and Thorotrast deposition in the vicinity of tumor cells. Thorotrast, a 25% colloidal suspension of thorium dioxide in aqueous dextrin, was used radiographically from 1928 until about 1950, when it was discontinued because of its implication in liver tumor development related to alpha-particle emission. The authors believe the unusually severe splenic atrophy in this case may be the result of Thorotrast administration during childhood when the cells are particularly vulnerable to toxic agents. Cancer of the spleen resulting from Thorotrast has been reported previously only once, and it is unclear why Thorotrast produces such differing effects on liver and spleen.

Real-Time Movie Images by Nuclear Magnetic Resonance. R. J. Ordidge, P. Mansfield, M. Doyle, R. E. Coupland; University of Nottingham. *Br J Rad* 5:729-733, 1982

The first real-time nuclear magnetic resonance (NMR) cine images are reported from cardiac motion in a rabbit. The new approach to NMR imaging, echo-planar (EP) method, is potentially able to increase the speed with which NMR images may be generated. The paper presents a series of six frames, each a cross-sectional view through the rabbit thorax. The authors discuss briefly the principles of echo-planar imaging and describe experimental details. The repetition rate of the experiment may be slowed arbitrarily from a maximum of six per second. In this experiment each frame was obtained from successive cardiac cycles by choosing the repetition period to be $(1 + 1/6)\tau$, where τ is the cardiac period as monitored by ECG. Faster framing rates, data transfer rates, and computation times will be available with newer computers and array processors. The rapidly switched magnetic fields in this experiment produced no observable ECG effects in animals. The authors believe that increasing the scale of the equipment for human application will present no insurmountable obstacles.

The Physics of Proton NMR. R. L. Dixon, K. E. Ekstrans; Department of Radiology, The Bowman Gray School of Medicine of Wake Forest University, Winston-Salem, N.C. *Med Phys* 9:807-818, 1982

The physics of pulse nuclear magnetic resonance (NMR)

techniques, which is pertinent to an understanding of proton NMR imaging, is presented by the authors. The basic, physical principles of spin manipulations using radiofrequency (rf) pulses are presented, and the relation between the quantum mechanical and classical descriptions is covered in a rigorous fashion. The physics of relaxation is described and the relaxation times T_1 and T_2 are explained in some detail. Applications of these spin manipulation techniques is illustrated by showing how they may be used in creating an image.

Transportation of Short-lived Positron Emitters from a Medical Cyclotron to a Remote Imaging Suite. J. A. Correia, W. H. Bucelewicz, H. W. Strauss, N. M. Alpert, G. L. Brownell, J. M. Taveras, V. Ferrari; Massachusetts General Hospital, Boston, MA and Reactor Experiments, Inc., San Carlos, CA. *Med Phys* 10:228-231, 1983

This paper describes the design, construction, and operation of a system for the transport of compounds labeled with short-lived, positron-emitting isotopes from a clinical cyclotron to a remote imaging suite 300 m away. The system is capable of transporting both batch lots of radioactive materials in a capsule through a pneumatic transport line and radioactive gases in a pressurized gas line. The capsules are propelled through the transport line by air from two tanks maintained at 5.45 atm pressure. These tanks provide enough air to send a capsule along the route and pulse the line pressure to maximum several times in the event of a jammed capsule. The tanks also ensure that a compressor or line air failure will not affect capsule transport. Capsule transport was studied as a function of driving pressure and an operating point of 1.5 atm was chosen, which results in a transport time of 6 sec. The rapid transport time resulted in a negligible exposure at 1 m. A model for the transit time of a gas was developed, which compared very well with experimental results. Personnel exposures were calculated for activity transported by either method, and the authors conclude that this is a useful and reliable tool for bringing cyclotron-produced isotopes into use in clinical nuclear medicine.

Ultrasonographic Diagnosis of Second-Trimester Skeletal Dysplasia: A Prospective Analysis in a High-Risk Population. A. B. Kurtz, R. J. Wapner; Thomas Jefferson University Hospital, Philadelphia, PA. *J Ultrasound Med* 2:99-106, 1983

A prospective study of 16 pregnancies in women at high risk for fetuses with skeletal dysplasias demonstrated a high degree of accuracy for sonography. Eleven fetuses were correctly determined to be normal and five correctly diagnosed as abnormal. Decrease in bone brightness, deformities of head and long bones, fractures, and abnormal growth rates for limbs were encountered. Such entities as achondroplasia, achondrogenesis, osteogenesis imperfecta, and hypophosphatasia were evaluated. Some abnormalities such as wormian bones in the skull, subtle deossification, abnormalities of wrist, foot, or ilium may go undetected particularly in the second and early third trimesters. A normal ultrasound examination during this period, therefore, may not entirely rule out an anomaly. Failure to confirm sonographic abnormalities on radiographs, however, does not exclude the possibility of their presence. Representative sonograms and radiographs are provided.

Ultrasound and Radionuclide Biliary Scanning in Acute Pediatric Abdominal Pain. J. P. McGahan, H. E. Phillips, R. C. Stadalnik, K. L. Cox, University of California, Davis, Sacramento, California. *J Clin Ultrasound* 11:251-258, 1983

A combination of ultrasonographic and scintigraphic techniques was used in the evaluation of pediatric patients with acute abdominal symptomatology referable to the right upper quadrant. Of 112 patients reviewed, seven were selected who had pain, nausea, vomiting, abnormal laboratory studies, and abnormal cholecystosonograms. Abnormal ultrasound findings included

thickened gallbladder wall (greater than 3 mm), abnormal pattern of gallbladder wall, increase in size of the gallbladder, and presence of intraluminal echoes. In two patients with surgically proven cholecystitis, the radionuclide scintigram was positive for cystic duct obstruction in both cases. Decrease in liver echogenicity was seen in acute hepatitis, and cholescintigraphy was found to be useful in such cases in predicting patency of the cystic duct. This can be of significant value in patients with hepatitis, since frequently on ultrasound images the gallbladder wall is seen to be thickened. Representative ultrasound and radionuclide studies are provided.

Effect of Display Format on Detectability. D. I. Thickman, M. C. Ziskin, N. J. Goldenberg; Temple University Medical Center, Philadelphia, PA. *J Ultrasound Med* 2:117-121, 1983

The authors used a liver-equivalent tissue phantom containing three circular objects each 1 cm in diameter; two were echo-free and the third was echogenic with posterior acoustic shadowing. A 1-mm, teflon-coated guidewire, small enough to produce a single echogenic focus without shadowing, was inserted within the tissue phantom. Using two formats, a series of images was evaluated by a group of trained observers to determine detectability of the wire. Specificity for the format in which a white-echo was displayed on a black background was 75%, exceeding that of the black-echo displayed on white background of 54%. The authors cautioned that this is a specific diagnostic task and does not necessarily imply that the white-echo format is superior in all cases. The test objects are presented.

Ultrasonographic Demonstration of Floating Particles in Amniotic Fluid. S. G. Parulekar; The Mt. Sinai Medical Center, Cleveland, OH. *J Ultrasound Med* 2:107-110, 1983

In a prospective study of 131 patients, of gestational ages ranging from 15 to 40 wk, floating particles ranging in size from 1 to 5 mm were seen in a significant proportion. Between 15 and 30 wk particles were seen in 45 to 60%; from 30 to 35 wk this phenomenon was identified in 88% of women, and from 35 to 40 wk in 100%. In one instance, particles visible at 31 wk gestation sonographically could not be identified in a specimen of aspirated amniocentesis fluid. The author suggest a possibility that these floating particles early in pregnancy represent aggregates of cells and cell fragments too small to be appreciated visually. Particles were identified largely in the deep, end portion of the uterus. The inference is that a demonstration of such particles cannot be equated with fetal maturity.

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