

## ABSTRACTS OF CURRENT LITERATURE

**NMR Imaging Produces No Observable Mutations or Cytotoxicity in Mammalian Cells.** J. L. Schwartz, L. E. Crooks; University of California, San Francisco. *Am J Roentgenol.* 139:583-585, 1982

The CHO/HGPRT (hypoxanthine-guanine phosphoribosyl transferase) assay was used to measure the induced mutation frequency of Chinese hamster ovary (CHO) cells exposed to static and radiofrequency magnetic fields similar to those used in magnetic resonance imaging (NMR imaging). Replicate cultures of growing cells were exposed for 24 hr under the following conditions: Exposure in a Varian electromagnet with 30 cm diameter pole tips and 10 cm gap; the imaging cavity enclosed by a radiofrequency coil 7 cm diameter, 9 cm long; the static field was 0.352 T (3,520 G); the RF exposure was 15 MHz with peak power of 1 W over 346 cm<sup>3</sup> volume, or 2.89 mW/cm<sup>3</sup>; the peak RF field in the coil was 7.38  $\mu$ T (0.0738 G). The RF was applied in three shaped pulses, each of 5 msec duration, with the first pulse a quarter of the intensity of the other two. Each of the three linear magnetic field gradients was pulsed on and off 2.5-10 msec, one of which was on during each of the RF pulses. At 2 cm from the coil center, the peak rate of field change was 4.6 T/sec. The average RF power was 15 mW. These exposure conditions duplicate those anticipated for human subjects in magnetic field strength, gradient pulse rate, and RF pulse rate. The magnetic field gradients are twice as strong, and the rise time ten times faster than for human imaging. The RF magnetic field is the same in both, but effective volume for human exposure would be about 250 times that for this test material. Cells were maintained at 37° during the imaging procedure. As a control, one culture of cells was exposed to 0.5  $\mu$ g/ml N-methyl-N'-nitro-N-nitrosoguanidine for 24 hr, and another control was unexposed. The surviving fraction of the control cells was reduced by 90%. In contrast, the 24-hr exposure to the 0.352 T static field, 4.6 T/sec changing field, and 7.38  $\mu$ T RF field produced no significant difference in cell survival from that of the unexposed control. The authors conclude that NMR imaging does not result in measurable genetic damage.

**Clinical Indications for Optimal Use of the Radionuclide Brain Scan.** A. P. Nisbet, G. E. Ratcliffe, S. V. Ellam, S. C. Rankin, M. N. Maisey; Guy's Hospital, London. *Br J Radiol* 56:377-381, 1983

A retrospective study is reported of 427 radionuclide brain studies performed in 1981 to evaluate the usefulness of such brain images in comparison with TCT. Patients were divided into the following categories: (a) known noncerebral primary tumors, suspected of metastases; (b) focal seizures; (c) migraine; (d) generalized epilepsy; (e) possible subdural hematoma; (f) patients without known underlying disorders, suspected of cerebral pathology outside the preceding groups; and (g) possible cerebral pathological condition with likelihood of vascular disease.

Data were acquired with a standard field gamma camera and data processing system. A dynamic study was performed after injection of 20 mCi (750 MBq) Tc-99m-labeled glucoheptonate. Static images were acquired in five projections at 90 min.

The authors conclude that because of its efficacy and relative

low cost, radionuclide brain imaging is the procedure of choice in Groups (a) and (e). Group (b) yielded eight positive images from 11 patients, indicating the procedure to be competitive with TCT. In the other categories they consider brain imaging to be less cost effective than TCT.

**Transient Hypothyroidism Following Radiolodine Therapy for Thyrotoxicosis.** J. M. C. Connell, T. E. Hilditch, D. C. McCrudden, W. D. Alexander; Western Infirmary and West of Scotland Health Boards, Glasgow. *Br J Radiol* 56:309-313, 1983

Fifty-five patients treated with I-131 for thyrotoxicosis were followed at 4-weekly intervals from 8 to 24 mo with T<sub>4</sub>, T<sub>3</sub>, TSH, and I-123 uptake measurements at 20 and 60 min. Five of the patients developed transient hypothyroidism, three of whom had normal or increased uptake at 20 min, suggesting impaired organification. The other two had decreased uptake at 20 min, which the authors associate with diminished trapping. Patients with permanent hypothyroidism consistently demonstrated this early depression of the thyroid uptake, and the authors believe this finding may be useful as a predictive test for permanent hypothyroidism, in contrast to the early normal or elevated uptake, which may indicate transient hypothyroidism.

**Influence of Propranolol on Uptake of Radiolodinated Heptadecanoic Acid and Thallium-201 in the Dog Heart.** E. E. van der Wall, G. Westra, M. J. van Eenige, S. Scholtalbers, F. C. Visser, W. den Hollander, J. P. Roos; Free University Hospital Amsterdam, 1007 MB Amsterdam, The Netherlands. *Eur J Nucl Med* 8:454-457, 1983

The effect of propranolol treatment on myocardial uptake of radiolodinated heptadecanoic acid I-131 HDA and Tl-201 was assessed in 20 dogs. Ten dogs received propranolol (0.15 mg/kg) 20 min before injection of 0.01-0.02 mCi of I-131 HDA and 0.01-0.02 mCi Tl-201. The same amount of radionuclide was injected in ten untreated dogs, which served as the control group. The total free fatty acid concentration was analyzed in multiple arterial blood samples. In each group, six dogs underwent coronary artery occlusion of the left anterior descending coronary artery. In the propranolol group the occlusion was performed 5 min before  $\beta$ -blockage. All dogs were killed within 2 min after radionuclide administration. The left ventricle was cut into four parallel slices, and each cross section was divided into eight segments. The radioactivity was then determined in a gamma counter. The total uptake of I-131 HDA and Tl-201 and the extent of the myocardial ischemia was not affected by propranolol treatment. A significant reduction in the uptake ratio endocardium:epicardium of the ischemic myocardial region was obtained in the control and propranolol group. The decrease of the ratio was less pronounced in the propranolol group, indicating a redistribution toward the ischemic subendocardial area. Plasma free fatty acid levels decreased after  $\beta$ -blockage in dogs with and without coronary artery occlusion. The reduction of free fatty acid plasma concentrations did not parallel I-131 HDA uptake, indicating a complex relationship between plasma levels and myocardial uptake.

**The Declining Specificity of Exercise Radionuclide Ventriculography.** A. Rozanski, G. A. Diamond, D. Berman, J. S. Forrester, D. Morris, S. J. Swan; Cedars Sinai Medical Ctr., Los Angeles, CA. *N Engl J Med* 309:518-522, 1983

Based on initial validation studies in angiographically normal patients, exercise radionuclide ventriculography (ERV) was thought to have a high specificity for the detection of coronary artery disease. Recent reports of high false-positive rates for exercise ejection fraction (66%) and exercise wall motion (47%) lead to this study to verify the fall in specificity and to determine the cause of the decline. A group of 77 patients was selected retrospectively based on the following three criteria: normal coronary angiogram; ERV performed within 3 mo of the angiogram; and no clinical or laboratory evidence of valvular heart disease, cardiomyopathy, coronary spasm, or previous myocardial infarction. They were subdivided into an "early" group (1978-1979) of 32 patients and a "recent" group (1980-1982) of 45 patients. Personnel, methods, and interpretative criteria were constant for the two groups. Specificity of ERV in the early group as compared with the recent group was 94% compared with 49% ( $p < 0.001$ ) for ejection fraction analysis and 84% compared with 36% ( $p < 0.001$ ) for wall motion response. The probability of coronary artery disease before ERV increased from  $7 \pm 14\%$  in the early group to  $38 \pm 35\%$  in the recent group ( $p < 0.001$ ), accompanied by a reversal in the testing sequence from ERV first in 22% of the early group to ERV first, in 78% of the recent group ( $p < 0.001$ ). Both preexamination bias—the referral of patients with a higher probability of coronary disease for ERV, and "postexamination" bias—the use of an abnormal ERV response as a criterion for performance of coronary angiography—account for the observed temporal decline in specificity.

**<sup>67</sup>Ga Scintigraphy, Serum Lysozyme and Angiotensin-Converting Enzyme in Pulmonary Sarcoidosis.** C. Alberts, J. B. van der Schoot, J. J. van Daatselaar, M. C. P. Braat, C. M. Roos; Department of Pulmonology, University Hospital (AZUA) Amsterdam, 1054 EG Amsterdam, The Netherlands. *Eur J Respir Dis* 64:38-46, 1983

Ga-67 citrate scintigrams, serum lysozyme (SL), and angiotensin-converting enzyme (ACE) levels were used for disease activity assessment in 34 patients with pulmonary sarcoidosis. Three subgroups were formed on the basis of the radiographic findings: (1) lymph node involvement without pulmonary abnormalities ( $n = 19$ ); (2) lymph node and pulmonary involvement ( $n = 13$ ); (3) pulmonary involvement without lymph node abnormalities ( $n = 2$ ). The disease activity was classified as improving, stable, or deteriorating, based on clinical, radiographic, and pulmonary function results. Gallium-67 scintigraphy was performed 48 hr after i.v. injection of 2 mCi Ga-67 citrate. The scintigrams were scored from 0 to 4 according to the amount of gallium uptake and the distribution of activity. All patients had a positive scintigram, and the mean score was 2.6 ( $n = 34$ ). A low positive correlation ( $r = 0.40$ ) was obtained for the SL and ACE values. Both enzymes correlate with the Ga-67 score (SL:  $r = 0.48$ , ACE:  $r = 0.50$ ). SL and ACE serum levels can be misleading, since normal SL and/or ACE values were found in about 30% of the patients. The mean Ga-67 score in subgroup 1 was 2.2 (range 1-3) and 3.1 (range 2-4) in subgroup 2. During follow-up, the disease activity was classified as improving ( $n = 11$ ), stable ( $n = 11$ ), or deteriorating ( $n = 2$ ). The results of successive Ga-67 scintigrams were in accordance with the disease activity classification. The scintigrams were positive in three patients with recurrent disease, whereas SL and ACE values remained normal. The authors conclude that Ga-67 scintigraphy is a more reliable parameter for the assessment of disease activity in patients with pulmonary sarcoidosis. Normal SL and/or ACE values do not exclude disease activity or progression.

**Focal Lung Uptake of Technetium-99m Methylene Diphosphonate Associated with Pulmonary Emboli and Hypercalcaemia (Case Report).** E. P. Wraight; Addenbrooke's Hospital, Cambridge. *Br J Radiol* 56:345-347

A 47-yr-old woman with advanced squamous carcinoma of the cervix was studied with a bone scintigram 4 hr following the injection of 15 mCi (550 MBq) Tc-99m labeled methylene diphosphonate. Although no bone metastases were seen, there were two areas of marked selective uptake in the base of the left lung and in the left upper lung posteriorly. A lung scintigraph with Tc-99m microspheres showed corresponding perfusion defects. A Xe-133 ventilation study was normal. This mismatch was suggestive of pulmonary emboli, a finding supported by a chest film showing subtle shadowing at the left base consistent with infarction. The marked accumulation of the labeled diphosphonate is considered by the authors to result from hypercalcemia and local tissue ischemia.

**Gastroesophageal Reflux: The Acid Test—Scintigraphy or the pH Probe.** J. J. Seibert, W. J. Byrne, A. R. Eler, T. Latture, M. Leach, M. Campbell; Univ. Arkansas, Little Rock, AK. *Am J Roentgenol* 140:1087-1090, 1983

Gastroesophageal scintigraphy (GES) offers a simpler, noninvasive, and lower radiation alternative to the upper gastrointestinal series and the pH probe monitoring techniques for the assessment of gastroesophageal reflux. To determine the sensitivity and specificity of the scintigraphic method, simultaneous 1-hr pH monitoring was performed with GES in 49 patients (41 infants, mean age 5.7 mo and eight children, mean age 9.1 yr) suspected of having gastroesophageal reflux. All patients were later studied with 24-hr pH probe monitoring and upper gastrointestinal (UGI) series. GES was performed after a 4-hr fast with a pH probe positioned in the esophagus. Tc-99m sulfur colloid, 100  $\mu$ Ci, was given orally in a small amount of water followed by milk formula. Posterior images of the neck and chest were obtained over a 1-hr period using gamma camera with data collection at 30-sec intervals by computer. Images were also taken at 4 hr to detect aspiration of tracer. Reflux was detected by time-activity curves along with percent gastric emptying. Using 24-hr pH probe monitoring as the "gold standard," the sensitivity and specificity of GES are 79% and 93%, respectively, compared with 86% and 21% for the UGI. It was found that only one episode of reflux on GES was necessary for a positive study, and the reflux was significant at any time during the 1-hr monitoring. Delayed gastric emptying did not correlate with reflux in GES, but was significant in that four of five patients with delayed gastric emptying had positive 24-hr pH probe studies.

**Clinical Validation of a Non-Invasive Radioisotopic Technique for the Study of Hepatic Arterial and Portal Venous Circulation.** A. Magrini, G. Izzo, A. Favella, S. di Luzio, L. Valeri, Z. Rossi, R. Picardi; University of Rome, 00185 Roma, Italy. *Ital J Gastroenterol* 15: 97-1104, 1983

The authors assessed a method for estimation of total intrahepatic blood flow (TIBF) and relative arterial perfusion (RAP) in normal patients and in patients with liver cirrhosis. A conventional gamma camera connected to a computer system was used for data acquisition after i.v. injection of 3-4 mCi Tc-99m HSA. Regions of interest were placed over the left ventricle, the right liver lobe, and the upper part of the intestine. Then time-activity curves were generated and the two flow parameters, TIBF, and RAP, were estimated from the data using a least squares method. The clinical value of these parameters was assessed in a study with 11 normal volunteers, 17 patients without liver disease, and 31 patients with liver cirrhosis. TIBF and RAP values showed no statistically significant difference in normals and in patients without hepatic

diseases. The mean values of TIBF and RAP were different when these two groups were compared with patients with cirrhosis. Furthermore, a significant negative correlation ( $r = -0.73$ ) existed between the two parameters in the cirrhosis group. This result demonstrates that the intrahepatic flow is reduced and the relative arterial perfusion is increased in patients with liver cirrhosis. The authors propose their method for routine use in the assessment of hepatic hemodynamics.

**I-131-Iodocholesterol (NP-59) Scintigraphy in Adrenocortical Diseases.** R. Taillefer, J. P. Soucy, M. C. Eybalin, A. Levasseur; Hosp. Maisonneuve, Rosemont, Montreal Quebec, Canada. *J Can Assoc Radiol* 34:120-124, 1983

The I-131 iodocholesterol (NP-59) imaging study reflects both structure and metabolism of adrenal glands. During a 5-yr period, 37 patients (30 women and 7 men, mean age 36.7) were selected for the study because tissue diagnosis was available. The interval between study and surgery was less than 2 wk in more than 80% of the patients. In 14 patients with Cushing's syndrome caused by benign adrenal adenoma, the scintigrams showed well-visualized adenomas with nonvisualization of the contralateral gland (100% accuracy). In ten patients with Cushing's syndrome due to bilateral pituitary-ACTH-dependent adrenocortical hyperplasia, the scintigrams showed bilateral and symmetrical radionuclide localization (100% accuracy). Ten patients with primary aldosteronism were included in the series, and in all but one (tumor size was only  $1.5 \times 1.0$  cm), scintigraphy showed asymmetrical uptake with higher activity on the side of adenoma, which was nonsuppressible by dexamethasone medication (90% accuracy). Two women with hyperandrogen (due to virilizing ovarian tumors) had normal adrenals, but the ovarian stromal lacteoma markedly concentrated the iodocholesterol whereas the arrhenoblastoma did not (100% accuracy). A patient with adrenal hematoma had no uptake in the imaging study (100% accuracy). The overall histological correlation with the scintigrams yields an accuracy of 97% (36/37). The authors concluded that NP-59 adrenal scintigraphy is a noninvasive and highly efficient procedure to determine the cause and to localize the site of excessive hormonal production after the clinical and biochemical diagnosis of adrenal disease has been established.

**Gallium-67 Scanning in Rheumatoid Arthritis.** I. W. McCall, H. Sheppard, M. Haddaway, W. M. Park, D. J. Ward; The Robert Jones and Agnes Hunt Orthopaedic Hospital, Oswestry, Shropshire. *Br J Radiol* 56:241-243

Ga-67 scans were performed on both knees of 38 patients with rheumatoid arthritis. The authors used a rectilinear scanner with the energy window set to accept 90 keV-300 keV and recorded the data on a video-display processor. The study showed significantly higher levels of Ga-67 accumulation in knees with synovitis. The Ga-67 knee:femoral ratio correlated well with the white cell concentration in the synovial fluid; however, Ga-67 scans did not demonstrate the presence or absence of sepsis. The authors conclude that quantitative Ga-67 knee scanning may be a useful adjunct to other methods to quantify rheumatoid activity.

**Bone Scintigraphy of Hip Joint Effusions in Children.** R. Kloiber, W. Pavlosky, O. Portner, K. Gartke; Children's Hospital of Eastern Ontario, Ottawa. *Am J Roentgenol* 140:995-999, 1983

The authors report the results of bone scintigraphy of 38 children with hip pain of acute onset. In children of this age, the major blood supply to the femoral head passes through the joint capsule and is subject to compression if intraarticular pressure exceeds venous pressure. Nine patients showed diminished activity in the proximal femoral ossification center, suggesting infarction or compression of the blood supply by a tense joint effusion, confirmed in eight patients by joint aspiration. Four of five patients were imaged

following joint aspiration and femoral head uptake had reverted to normal; the fifth one proved to be infarcted. The authors consider bone scintigraphy to be useful in the diagnosis of joint effusions, and follow-up studies can differentiate infarction from reversible ischemia.

**Thallium-201 Imaging Artifacts Not Detected by Technetium-99m or Cobalt-57 Quality-Control Testing.** S. J. Lukes, L. W. Grossman, H. Nishiyama; *Radiology* 146:237-239, 1983

Most institutions routinely obtain flood field images as a quality control procedure. Uniform images are generally accepted as proof that a scintillation camera is operating properly and that artifacts will not be produced in images used for clinical diagnoses. The authors demonstrate a particular type of crystal defect that can produce artifacts in thallium heart images and technetium liver images even though the quality control images obtained with Co-57 or Tc-99m appear uniform. Flood-field images taken with Xe-133 and Tl-201 revealed foci of increased uptake. Images taken with Tc-99m using a 5% window at the lower edge of the photopeak revealed phototube nonuniformities as well as the areas of increased uptake shown in the Tl-201 and Xe-133 images. Inspection of the crystal after removal from the camera revealed a broken hermetic seal and at least a dozen small, vague shadow areas close to the entrance side of the crystal. There was a one-to-one correspondence between these areas and the defects observed in the flood-field images; thus the defects were caused by a crystal in the early stages of hydration. This phenomenon can produce either increases or decreases in reflectivity. Because more of the scintillation events for Tl-201 and Xe-133 occur near the entrance surface of the crystal, as compared with Tc-99m, the effect of altered reflectivity was apparent even in images taken with symmetrical windows. The authors suggest that the appearance of these areas as foci of increased uptake is probably due to changes in the scintillation light distribution in the crystal as a function of position. As a result, localized edge-packing effects were produced around each hydrated area. The use of narrow, asymmetrical windows to check for this degradation is more convenient than the use of Tl-201 or Xe-133 although use of the latter may be more reliable. Uniformity correction reference images based on Tc-99m or Co-57 would not eliminate these artifacts. The authors suggest that all cameras, especially older units, should be checked on a monthly basis.

**Review of Image Reconstruction Techniques in Medical Transaxial Computed Tomography.** M. Jatteau, C. Berche; Laboratoires d'Electronique et de Physique Appliquée, 94450 Limeil-Brevannes, France. *Ann Radiol* 26:13-22, 1983

The basic principles of single photon emission computerized tomography and the main image reconstruction algorithms were discussed. Most of the analytical convolution techniques use the back projection. Data filtering is performed before back projection of filtered projection (BPFP) or after back projection [back projection and image filtering: (BPIF)] to avoid blurring effects. Filtering can be performed in the real or Fourier domain. The time domain should be preferred to save computing time. The Fourier synthesis theorem (FST) is based on the superimposition of the filtered one-dimensional Fourier transform of the acquired projections. The two-dimensional inverse Fourier transform represents a tomographic slice. The FST technique is the fastest reconstruction algorithm (1 sec/slice). BPFP and BPIF are equivalent when the filtering is performed in the time domain (BPFP, 3 sec/slice; BPIF, 4 sec/slice). BPIF is inferior to BPFP, when the real domain is preferred for filtering (BPFP, 4 sec/slice; BPIF, 45 sec/slice).

The iterative algebraic reconstruction techniques (ART) are based on the following principle: a) estimate a preliminary image; b) compute the projections of this image; c) compare these pro-

jections with the acquired projection data; d) correct the preliminary image correspondent to the differences between the computed and measured projections; e) proceed to b) until convergence. The simultaneous iterative reconstruction technique (SIRT) and the iterative least-square technique (ILST) are more sophisticated ART algorithms and are less sensitive to noise. All ART techniques are time-consuming compared with the analytical reconstruction methods. As far as the x-ray attenuation compensation is concerned, one of the common attenuation correction methods must be added to the analytical convolution techniques. Compensation is included in ART, since the computed data were compared with the measured projections. Nonhomogenous absorption media could give rise to problems with both reconstruction methods.

**A Scan Artifact Caused by a Band of Scattered Photons.** U. Y. Ryo, D. J. Wilczak, I. Kim, S. M. Pinsky; Michael Reese Hospital, Chicago, IL. *Radiology* 146:840-841, 1983

The attenuation of photons occasionally produces defects in radionuclide images. Most often seen are defects in liver images caused by overlying breast tissue, but areas of increased activity on liver scintigrams may also be seen and are probably caused by scattered photons from the breast. This latter phenomenon, called the "stripe" sign, has also been observed in brain images and is caused by braids or toupees. The authors studied this problem in liver and brain images and with phantoms to verify that the "stripe" sign was caused by scattered photons. In liver studies a repeat scintigram was obtained with the breast retracted; in brain imaging the study was repeated with the braid combed out or the toupee removed. Examples of the change in image appearance are shown in the article. In each case the band of increased uptake disappeared. To study this problem, phantoms containing rice and water were used to generate images, which were stored in computer disks. Image subtraction techniques verified the cause of the "stripe" sign and dramatized its appearance. It is important to remember that any object that interferes with the flux of a large number of photons through attenuation or small angle scattering can produce artifacts in liver, brain, and heart scintigrams. Failure to keep this problem in mind may lead to false-positive interpretation.

**Radiation Absorbed-Dose Estimates for the Liver, Spleen, and Metaphyseal Growth Complexes in Children Undergoing Gallium-67 Citrate Scanning.** S. R. Thomas, M. J. Gelfand, G. Scott Burns, et al; Eugene L. Saenger Radioisotope Lab. *Radiology* 146:817-820, 1983

The widespread use of Ga-67 for diagnosing tumors and inflammatory disease in adults has recently been expanded to include studies of children. Because of the difference in uptake, distribution, and clearance of this radiopharmaceutical in the two populations, it is necessary to measure these parameters in order to provide accurate estimates of the radiation absorbed dose with a scintillation camera. The authors used the conjugate-view counting technique in ten children to quantitate the activity in the liver and spleen and in the metaphyseal growth complexes of the distal femur and proximal tibia. Corrections were included for surrounding diffuse nontarget organ activity and for overlapping focal areas of uptake. To provide information on clearance of the radioactivity, three measurements were made over a 3-day period. In the organ-regions studied, there was no biological clearance of the Ga-67 citrate. The dose estimates are provided in rad/mCi (Gy/GBq) and rad/(50  $\mu$ Ci/kg) [mGy/(MBq/kg)]. In all but one subject, the absorbed dose values were higher for the liver and spleen than the commonly accepted values for adults. The data, however, were biased by the fact that all of the children had chronic illnesses. In this small sample there was no apparent correlation between the dose values and the ages of the children, probably due to the varied diseases of the patients. The high dose to the meta-

physeal growth complexes indicates that the growth regions of bone may be the critical organ in pediatric studies.

**Review Article: The Radiological Effects of Nuclear War.** Report of a British Institute of Radiology, Working Party, J. W. Boag, Chairman and five others. *Br J Radiol* 56:147-170, 1983

The British Institute of Radiology Council reports the destructive potential of nuclear weapons, with special reference to radiation and radiological aspects. The report is confined to weapons effects and not to methods of their delivery. This abstract is necessarily a greatly condensed synopsis of their 24 page paper. They discuss the physical principles of fission weapons, thermonuclear weapons, and the neutron bomb, or enhanced radiation weapon. Fission weapons are generally thought to be designed to go critical by the "implosion" method, with yields limited usually to about 100 kilotons. The much more powerful thermonuclear weapons use a fission trigger to initiate the fusion reaction, compressing and heating the fusion fuel  $^6\text{LiD}$ . The fusion core may be surrounded by a  $^{238}\text{U}$  mantle, contributing at least half the explosive energy from fast neutron fission and generating nearly all the fallout. Weapons ranging from 1 to 20 megatons are thought to be in arsenals of the nuclear powers. Omission of the uranium mantle results in the "neutron bomb," designed for battle field use with yields about 1 kiloton. Other designs of the "clean" bomb with much greater yields are available. The paper discusses modes of damage: initial gamma and neutron radiation, blast and shock waves, thermal radiation, "fallout," and other effects, such as the electromagnetic pulse, ozone depletion, etc. A number of charts show the intensities of these effects as functions of weapons yield, distance, and time factors, and the effects of multiple weapons. Designs are discussed for shelters against blast and fallout. Depletion of the ozone layer resulting from a thermonuclear exchange might be disastrous for any surviving life forms. However, at present this effect is not predictable. The last quarter of the paper reviews the biological effects of nuclear weapons, types of exposure, stages of radiation sickness, and lethal dose considerations. Medical care would face an overwhelming task and would be largely confined to the alleviation of symptoms and directed primarily to cases of moderate injury likely to recover. There would be many victims suffering various combinations of radiation, trauma, and burn. The study compared these effects from different types of weapons at various distances and atmospheric conditions. Disabilities of survivors would include cataracts, damage to embryos, infertility, aging, carcinogenic effects, and genetic effects. The immediate casualties from a major thermonuclear exchange between the Soviet Union and the United States could number 265 million deaths and 133 million injured. The survivors would face death from injuries, economic disruption, and deprivation.

**Relationship of Cerebral Intraventricular Hemorrhage and Early Childhood Neurologic Handicaps.** L. Papile, G. Munsick-Bruno, A. Schaefer; University of New Mexico School of Medicine, Albuquerque, NM. *J Pediatr* 103:273-277, 1983

In a group of 260 infants with birth weight less than 1501 g, cerebral intraventricular hemorrhage (CVH) was detected in 43%. Risk factors included: male sex, outborn, assisted ventilation, multiple gestation, 1-min Apgar score less than 4, or birth weight less than 1200 g. After an initial study by TCT scan, patients were followed with either sequential ultrasound examinations or follow-up TCT scans. Using the established system of grading severity of hemorrhage, the authors found no ventricular dilation in infants with grades 1 or 2 and no increase in developmental handicaps as compared with infants without intraventricular hemorrhage. Of those infants with grade 3 CVH 50% showed progressive ventricular dilations, and 55% of those with grade 4 hemorrhage also showed progressive ventricular enlargement. Fifty-eight percent

of infants with grades 3 and 4 CVH had major handicaps, with 45% of this group manifesting multiple handicaps. The authors conclude that grades 1 and 2 CVH are not associated with an increased incidence or major handicaps in early childhood; grades 3 and 4 CVH, however, show a direct relationship to major handicaps.

**Sonographic Differentiation of Extra- and Intrahepatic Masses.** M. Graif, A. Manor, U. Itzhak; Chaim Sheba Medical Center, Tel-Aviv University, Sackler School of Medicine, Tel-Hashomer, Israel. *Am J Roentgenol* 141:553-556, 1983

The authors examined six separate sonographic features of right upper quadrant masses to determine intra- compared with extrahepatic location. Twenty-five patients with intrahepatic masses and 33 patients with extrahepatic lesions constituted this study. Discontinuity of the liver capsule (i.e., loss of definition of the border) was typical of extrahepatic masses. Inward displacement of the liver capsule was characteristic of extrahepatic lesions as opposed to outward bulging, which was seen exclusively as a result of intrahepatic masses. Identification of the wedge of fat between the liver and the mass was seen only in extrahepatic lesions. The inferior vena cava was displaced anteromedially in extrahepatic masses and posteriorly as a result of intrahepatic lesions. The right kidney was similarly displaced anteriorly by extrahepatic masses and inferiorly by intrahepatic processes. Displacement of portal or hepatic vessels was more characteristic of intrahepatic than extrahepatic masses. Masses exceeding 10 cm in diameter were more difficult to categorize by these criteria.

**$\beta$ -Subunit of Human Chorionic Gonadotropin, Ultrasound, and Ectopic Pregnancy: A Prospective Study.** S. C. Peter Bryson, University of Toronto, Toronto, Ontario, Canada. *Am J Obstet Gynecol* 146:163-165, 1983

The combination of a serum  $\beta$ -subunit of human chorionic gonadotropin determination and ultrasonography produced nearly 100% accuracy in the diagnosis of ectopic pregnancy. In a prospective study of 81 patients, those manifesting two or more of a group of symptoms including pelvic pain, amenorrhea, abnormal uterine bleeding, or palpable pelvic mass were studied by a qualitative  $\beta$ -hCG screening. Those with unsatisfactory pelvic exami-

nation, adnexal fullness, or positive  $\beta$ -hCG screen were studied with ultrasound. The  $\beta$ -hCG was considered negative at less than 35 mIU/ml and positive if greater than 65 mIU/ml; a borderline result was considered positive in the current study. All 13 patients with positive  $\beta$ -hCG levels and no intrauterine pregnancies by ultrasound subsequently proved to have ectopic gestations. Definite adnexal pathology was seen by ultrasound in only 46% of patients with proven ectopic pregnancies.

**The Use of Ultrasound in Evaluating Problems and Complications of Genetic Amniocentesis.** C. R. McArdle, W. Cohen, C. Nickerson, L. E. Harn; Beth Israel Hospital and Harvard Medical School, Boston, MA. *J Clin Ultrasound* 11:427-429, 1983

As a result of a prospective study of 460 mid-trimester amniocenteses, the authors suggest that real-time guidance of this procedure can be of significant value. In 27 instances (5.8%) the needle was seen piercing the fetus; however, serious damage resulting in interuterine death or severe deformity was extremely uncommon. If fluid was not obtained after insertion of the needle, the real-time transducer was used to localize the tip of the needle precisely and determine the cause of a dry or bloody tap. Thickening of the uterine wall, tenting of the membranes, and blocking of flow by the fetus were observed by this method as well. Direct ultrasonographic visualization was used in 28.5% of amniocenteses performed and served to prevent potentially serious sequelae and minimize unsuccessful taps. The authors suggest that if clear fluid is not obtained at a sonographically predetermined sight and depth, real-time guidance be used to complete the procedure under direct visualization.

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