

ABSTRACTS OF CURRENT LITERATURE

The Future of Radioimmunoassay. R. S. Galen. *Human Path* 8: 359-360, 1977.

From its inception nearly 2 decades ago, radioimmunoassay (RIA) has become utilized widely and is well accepted in the clinical laboratory. The diversity of commercial tests and required instrumentation available reveals that RIA is a major industry. Manufacturer attempts to totally automate RIA procedures, however, have yielded expensive instruments that lack flexibility and versatility and bear potential for obsolescence. The pathologist finds himself trying to keep up with technologic change while facing ever-increasing budget restrictions. A current competitor to RIA is the enzyme immunoassay (EI) that employs no radionuclide but maximizes the specificity and sensitivity of antigen-antibody techniques. First generation EI's are available for drugs of abuse, anticonvulsants, digoxin, and thyroxine (T_4). EI is characterized as faster and simpler than RIA and susceptible to automation on existing laboratory enzyme analyzers or multichannel serum chemistry profiling instruments. In addition to the elimination of radioactivity, T_4 testing by EI is cheaper and easier to perform than by RIA and provides an especially valuable addition to the serum chemistry profile. RIA, which generally shows increased sensitivity over EI, will remain viable for many assays. High volume routine hospital tests (e.g., T_4 and digoxin) should point the trend to technologic changes, if any. The pathologist now interested in expanding his RIA capability is advised to purchase versatile and flexible component laboratory instruments to be prepared for the technologic changes to come.

Error in Anti-DNA Antibody Radioimmunoassay after Gallium Scanning. D. Torretti, P. Mooney, G. W. Williams, and J. L. Decker. *Annals of Int Med* 86: 309-311, 1977.

In systemic lupus erythematosus (SLE) the presence of antibody to DNA in serum is associated with that disease. Retrospectively, four SLE sera were observed that demonstrated negative DNA binding capacity as measured by the modified Farr technique. The patients' histories revealed that all four had undergone Ga-67 imaging within a week before the DNA measurement. DNA studies were then performed by the modified Farr technique and by a cellulose filter technique (both of which employ ^{14}C -labeled DNA) on an SLE patient before and after injection of Ga-67 citrate (50 $\mu Ci/kg$). The administration of Ga-67 led to false-negative antibody results (modified Farr) and the influence was noted for 17 days after Ga-67 administration. False positive results were found by the filter method for a period up to 10 days after administration of radiogallium. Serum samples withdrawn 1-10 days after Ga-67 administration and stored frozen to allow Ga-67 decay yielded antibody values similar to those obtained before Ga-67. The radioactive gallium appears to be the source of radioactivity that

appeared in the C-14 window of the liquid scintillation spectrometer. No similar serum interference was encountered in patients at 24 and 48 hr after Tc-99m macroaggregated albumin or I-131 (thyroid uptake). The artifact appears attributable to the persistence of Ga-67 in patients' sera following administration of the radionuclide. It is recommended that critical measurement of anti-DNA antibody be performed before Ga-67 imaging.

Effect of Purification on the Accumulation of Radioactive Gallium Labeled Leukocytes in Abscesses. R. J. Kroeger, R. L. Burleson. *Surg Gynecol Obstetrics* 144: 741-744, 1977.

Abscesses were experimentally induced in the abdominal wall of rabbits. Separately, leukocytes from animals in group A were labeled at room temperature by incubation of 30 ml heparinized blood with Ga-67 citrate for 30 min and then purified by dialysis against saline. For further purification, the purified, labeled cells were washed with saline, separated from the solution, and subsequently resuspended in saline; this yielded the labeled cells of group B animals. Group C animals were identical to group B except that the initial volume of blood labeled was 60 ml. Autologous labeled leukocytes from all three groups of animals were then reinfused into the respective rabbits, which were killed 24 hr later, and the abscess wall plus organs were excised and assayed for radioactivity. Gallium-67 cell labeling efficiencies were 9%, 2.2%, and 2% for groups A, B, and C, respectively. Group B animals showed increased radioactivity concentration in abscess wall over that in liver, lungs, kidney, and heart blood when compared with animals in group A. Increasing the number of cells for labeling (group C) further enhanced the concentration of radioactivity in the abscess wall compared to that in the liver, lung, heart blood, and normal abdominal wall. Increased lung uptake of labeled leukocytes, which might reflect leukocyte damage from dialysis and washing, was not evident. The authors feel that purified labeled leukocytes should offer potential for clinical abscess imaging.

A Quantitative Assessment of Femoral Head Activity Using ^{99m}Tc -Polyphosphate and a Computer Data Collection System. D. F. Dowsett, M. S. Short, and T. R. Morley. *Brit J Rad* 49: 540-546, 1976.

The purpose of this study was to establish a comparative reference point that could be utilized in sequential studies for the assessment of femoral head concentration of labeled phosphate compounds. Eighteen children of both sexes between the ages of 4 and 10 yr with either suspected or confirmed Perthes' disease were studied. Polyphosphate bone scans were performed as a diagnostic procedure, before corrective surgery, 3 mo after surgery, and in some cases 6 mo after surgery. A number of normal hips formed a control group. The labeled polyphosphate was administered

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on a body-weight basis. Radionuclide images were obtained with both rectilinear instrumentation and gamma camera. The camera images were obtained from the patient with the femoral head region in the upper half of the camera field, and the bladder activity adequately shielded. A total of 500,000 counts was collected and stored in the computer. Since the reliable quantitation of the data depended on a suitable reference site, the authors found that the femoral shaft was the most suitable. The computer program automatically selected the maximum count area for each femoral head, and after data processing, the centroid value of this maximum area was compared to the reference value from the upper femoral shaft region that provided an uptake ratio for each femoral head. The authors found that for the normal child between ages 4 and 11 the mean ratio value fell between 3.1 and 3.7. The cases of Perthes' disease showed consistently high uptake values. Lower values were found following surgery from decreased femoral head activity. The value of their reference point selection was the fact that it was unaltered after surgical procedure or short interval between followup studies. Early abnormality could be measured in both unilateral and bilateral femoral head pathology.

Computerized Axial Transverse Tomography in Normal Pressure Hydrocephalus. L. Jacobs and W. Kinkel. *Neurology* 26: 501-507, 1976.

The authors obtained computerized tomographic studies on 20 patients (age 50-79 yr) with a diagnosis of normal pressure hydrocephalus. The diagnosis was made on the basis of clinical and radiographic finding. Each patient had a pneumoencephalogram and a radionuclide cisternogram. The cisternograms were interpreted as (a) "characteristic" of normal pressure hydrocephalus with ventricular reflux stasis and no activity over the convexities, or (b) "mixed" with basilar cistern activity or slow flow in the sylvian fissure regions combined with some degree of ventricular retention. A diagnosis of normal pressure hydrocephalus was not made if there was radioactivity over the convexities or parasagittal regions after 24 or 48 hr. The patients had ventriculoatrial shunting and were evaluated at regular intervals. The average followup duration was 23.5 mo (3-48 mo). The interpretation of the response to ventricular shunting was categorized as (a) no improvement, (b) moderate but incomplete improvement, or (c) complete improvement with total disappearance of symptoms. The CT scans confirmed the pneumoencephalographic findings of hydrocephalus without cortical atrophy in 13 cases. In the seven remaining patients, CT studies showed significant cortical atrophy that was not demonstrated by pneumoencephalography. The authors found no correlation between the radioisotopic cisternogram appearance and (a) the presence or absence of cortical atrophy or (b) the clinical responses to ventricular shunting. There was no relationship between the presence or absence of cortical atrophy and the clinical responses to ventricular shunting. Forty percent of the patients had persistent markedly enlarged ventricles following ventricular shunting. The authors could provide no adequate explanation for this finding and concluded that the current concepts of normal pressure hydrocephalus must be revised in view of their findings.

Correlation between Computerized Transaxial Tomography and Radionuclide Cisternography in Dementia. M. H. Gado, R. E. Coleman, K. S. Lee, M. A. Mikhael, P. O. Anderson, and C. R. Archer. *J Neurology* 26: 555-560, 1976.

The authors studied 44 patients with dementia, all of

whom received computerized tomography scans and radionuclide cisternograms. The CT studies were obtained with eight 13-mm thick slices. Radionuclide images were obtained following intrathecal administration of In-111 DTPA, and views were obtained at 4, 24, 48, and frequently 72 hr. The CT images were evaluated for size of lateral ventricles and cerebral sulci. The radionuclide images were evaluated for presence or absence of ventricular reflux, duration of refluxes present, and the temporal rate of flow over the hemispheres. The interpretation of the 44 cisternograms were: cerebral atrophy (21), communicating hydrocephalus (12), intermediate pattern (9), normal pattern (2). In the 12 patients with cisternographic pattern of communicating hydrocephalus, six had moderate and six had severe ventricular dilatation by CT scan. Of the 21 with cerebral atrophy by cisternography, CT was interpreted as severe dilatation of ventricles in one patient, moderate in 11, slight in 7, and normal in two. Half of the patients with cerebral atrophy by cisternography demonstrated widening of cerebral sulci by CT studies. Of the nine patients with an intermediate cisternographic pattern, the size of the lateral ventricles varied from normal to severely dilated. The authors found good correlation between radionuclide cisternography and computerized tomography; however, the most consistent correlation was found in those patients with communicating hydrocephalus. The authors also presented a scheme for the interpretation of the studies.

An Intravenous Isotope Method for Measuring Regional Cerebral Blood Flow (rCBF) and Volume (rCBV). Jyrki Kuikka, Aapo Ahonen, Antero Kaivula, Topani Kallanranta, and Juhani Laitinen. *Phys Med Biol* 22 (5): 958-970, 1977.

A Xe-133 i.v. injection method along with quantitative dynamic Tc-99m brain scintigraphy was used in 43 hospital patients to measure simultaneously regional cerebral blood flow (rCBF), initial slope index (ISI), transfer time (tf), and volume (rCBV). A gamma camera/digital computer system was used for the data acquisition. The paper presents a detailed description of the mathematical model and gives a flow chart of the data processing algorithm. Mean values and standard deviations obtained from 50 control hemispheres are presented. Good agreement was found between the blood flow values determined from the intra-arterial and i.v. techniques.

Estimation of Organ Depth by Gamma Ray Spectral Comparison. Kenneth F. Koral, and A. R. Johnston. *Phys Med Biol* 22 (5): 988-993, 1977.

A method for determining organ depth for purposes of quantitating the amount of radiotracer in an organ is presented. The method applies to data recorded from a single detector in a fixed position. Spectra are recorded from calibration sources placed at different depths in a water phantom. Test spectra are then taken for fixed times with sources placed at various depths. The source depth is calculated by comparing a test spectrum with the calibration spectra. A detailed description of the method is presented.

Algorithms for Two-Dimensional Reconstruction. A. M. Cormack and Brian J. Doyle. *Phys Med Biol* 22 (5): 994-997, 1977.

An argument is presented against using all recorded measures of the line integrals in computing the densities of points in an object in two-dimensional reconstruction applications. Use of the unnecessary data points, although it may contribute to noise reduction, generates a noise-like error at all but a few points at which reconstruction is made. The

authors give an example using the Radon transform algorithm to illustrate the point. In addition to reducing the noise, the elimination of the unnecessary points results in a saving in computer time, since the number of calculations is reduced by a factor of two.

A Simple Mathematical Lung Model for Quantitative Regional Ventilation Measurement Using $^{81}\text{Kr}^m$. F. B. Ajzer and J. Nosil. *Phys Med Biol* 22 (5): 975-980, 1977.

A method for determining the regional specific lung ventilation using Kr-81m is presented. The method is a modification of one reported by Winlove using a correction for radioactive decay of the tracer in the lung. The mathematical model is described. Data obtained from two healthy patients are discussed.

Ultrasonic Diagnosis of the Bladder as a Symptomatic Pelvic Mass. T. G. Lee and T. A. Reed. *J Urol* 117: 283, 1977.

The authors present two cases—middle-aged men presenting with abdominal pain and left lower quadrant tenderness. Intravenous urography and barium enema revealed pelvic masses, and ultrasonographic examination delineated these as cystic. After voiding or catheterization of large volumes of urine from the patients, the symptoms subsided. Both patients had prostatic enlargement, and transurethral prostatic resections relieved symptoms completely. The authors suggest that a distended bladder as a symptomatic pelvic mass should be considered in patients with an obscure clinical history and vague pelvic symptoms and that ultrasonography is ideally suited to the diagnosis of the pelvic mass as being cystic.

Diagnosis of Gynecologic Pelvic Masses by Gray Scale Ultrasonography. Analysis of Specificity and Accuracy. T. L. Lawson and J. N. Albarelli. *Am J Roentgenol* 128: 1003-1006, 1977.

In a series of 251 proven cases ultrasonography correctly identified the presence or absence of a mass in 229, representing an overall accuracy of approximately 91%. The 22 errors were attributed to such problems as overinterpretation of loops of bowel, technically poor examinations, and lesions at the lower limit of resolution of the method. The authors describe and display examples of a spectrum of gynecologic masses; ultrasonograms of such entities as ovarian cystadenocarcinoma, ovarian dermoid, ectopic pregnancy, and malignant ascites are presented. Abscesses were the most common of the 46 sonographically complex masses, and 37% of these pelvic masses could not be separated from the uterus by ultrasound. All of the cystic masses proved to be extrauterine; 73% of these were simple functional ovarian retention cysts; and 20% proved to be pelvic abscesses. The correct diagnosis was made in nine out of 13 patients with proven ectopic pregnancies, and an extrauterine mass was identified in all cases. Clinical history was vitally important in making the correct diagnosis. The authors caution against making the diagnosis of a mass if the findings are not easily reproducible and cite several instances in which loops of bowel or adhesions were misinterpreted as pelvic masses.

The Volumetric Growth of the Human Placenta: A Longitudinal Ultrasonic Study. O. P. Bleker, G. J. Kloosterman, W. Breur, and D. J. Mieras. *Am J Obstet Gynecol* 127: 657, 1977.

The authors devised a method for calculating placental volume using a longitudinal scan with the cross-sectional views. The volume of the body of the placenta (between the upper and lower cross-sectional scans) was calculated and added to the volumes of the "placental caps" at either end. In a study of twelve patients examined at biweekly intervals from 23 wk of menstrual age to term, the authors found the placentas to have reached maximum volume well before the end of pregnancy. Comparison of the placental volume measured postpartum with that of the in situ measurements correlated well. The inference is that placental volume in situ should always be greater than the postpartum volume by virtue of the transportation of fetal blood to the neonate immediately following birth. The findings contradict a previous study based on cross-sectional data. The conclusion of the study is that the human placenta stops growing before the end of pregnancy, and the authors postulate that the decrease in blood volume of the maternal component is a possible explanation. They theorize further that the limits of intrauterine fetal growth may in fact be set by the placenta several weeks before the end of pregnancy.

Ultrasonographic Assessment of Neck Masses. G. A. W. Gooding, K. A. Herzog, F. C. Laing, and E. J. McDonald. *J Clin Ultrasound* 5: 248, 1977.

Fourteen patients with neck masses ranging in diameter from 1 to 10 cm were evaluated; twelve had clinically palpable masses. The authors discovered a broad spectrum of ultrasonographic appearance of cervical lymph nodes and compassing cystic, solid and complex appearances. Cervical adenitis apparently produces different sonographic pictures depending upon the stage of development of the inflammatory process at the time of scanning. As the adenitis progresses toward abscess formation, the solid appearance gives way to a complex one, and thence to a frank cyst in the presence of abscess formation. Sebaceous cysts and branchial cleft cysts were easily identified as being homogeneous fluid densities. Of the five primary tumors of the neck, four were solid and one complex, the latter proving to have a compartment of hemorrhage and necrosis. The authors note the value of ultrasonography in assessing the extent of a hematoma resulting from a carotid endarterectomy and show, quite clearly, compression of the common carotid artery by hematoma at the endarterectomy site. The method has no predictive value with respect to histology of a mass, but provides valuable adjunctive information regarding its internal architecture.

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