Performance of Scintillation Cameras

A recent letter by Hine and Paras (*1*) deserves a word of comment because it omits important data on Baird-Atomic's "System Seventy." The System Seventy is the only multicrystal camera—indeed, the only scintillation camera—with published performance specifications for count-rate and deadtime correction (*2,3*). The operating count-rate range for the System Seventy extends up to 200,000 observed and retrievable counts per second, obtained with up to 33 mCi of ^{99m}Tc and the 1.5-in.-thick collimator. This observed rate corresponds to a true input-event rate of up to 400,000 events per second. The standard 2.5-in.-thick collimator resolves 2.8-mm bars at the surface of the collimator and has a FWHM of 3 mm. In the scan mode the multicrystal camera has no intrinsic spatial resolution component, this resolution being defined only by the collimator response (*2*). For example, using the 4-in.-thick collimator, 3-mm bars are resolved at 4 inches from the surface of the collimator.

High count-rate capability and accurate deadtime correction, as well as invariance of the spatial resolution with increasing count rate, are absolute necessities in any system required to perform quantitative dynamic studies such as radionuclide cardiography.

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Measurement of Serum Triiodothyronine Concentrations

For the past 14 months we have used the commercial resin-strip technique for the measurement of serum triiodothyronine (T_3) concentration as described by Burman et al (*1*) in the July 1975 issue of this journal. From our experience we think that several aspects of the technique should be emphasized.

Although we have been unable to achieve the remarkably small coefficient of variation [CV = (standard deviation/mean) × 100%] claimed by the manufacturer, we find that the precision of the method is much better than that observed by Burman et al (Table 1). Our procedure differs from that of the Burman group only in minor details. We feel that careful attention to pipetting and to draining the resin strips when they are removed from the reaction vials makes triplicate samples unnecessary. Our samples are all analyzed in duplicate, using glass chemical micropipets (Lang–Levy) for each critical pipetting step (patient serum, standard, and antibody solutions), and the resin strip is rotated at room temperature, usually 23–26°C. We have consistently obtained CVs of 9–10% over a period of 9 months, using 13 different lot numbers of reagents and involving 77 assays of frozen and thawed pooled serum by five different analysts. We do not use commercial lyophilized control serum since lyophilized controls are often less reproducible than laboratory-prepared frozen pooled serum.

Our initial "normal range" (74–153 ng/dl), determined on 25 healthy volunteers, agreed remarkably well with that of Burman et al. Our normal values were somewhat lower than those suggested by the manufacturer and certainly lower than those reported by most research laboratories using various other antibodies with unknown cross-reactivity with thyroxine (T_4). As most clinical laboratories are forced to do, we used volunteer technologists and students as normal subjects. This biased the normal range to describe best the 20–30-year-old population. When this "normal range" was applied to the general hospital population, a great many euthyroid patients over 50 years of age were misclassified as being hypothyroid. Similarly, many elderly patients, clinically hyperthyroid, were included in the "normal T_3 concentration range."

A brief survey of the literature revealed numerous reports that T_3 concentrations in serum, in contrast to T_4, are highly age-dependent (*2–4*). Thus, to speak of a single "normal range" without specifying the ages of the subjects is clinically meaningless. Based on the observations of Brunelle and Bohuon (*2*) that T_3 concentrations decline 5 ng/dl for each decade of life, we established our normal range using only 20–30-year-old subjects (79–150 ng/dl) and then constructed the nomogram shown in Fig. 1. Since the precision of the assay in our laboratory was ±10%, one standard deviation was added and subtracted from the extremes of the normal range to indicate "borderline values." The validity of the nomogram was confirmed by reviewing the clinical records of patients with previously determined T_3 values; we found a much better correlation with clinical status when we used the age-dependent nomogram than when the single "normal range" was used for all subjects.

Our experience, supported by that of many others, has been that T_3 determinations are of great value in the diagnosis of developing hyperthyroidism (when T_4 concentrations are often still within the normal range) and in monitoring the dosage of exogenous thyroid medication required for replacement therapy. Caution must be employed, however, in using the T_3 analysis to evaluate the possibly hypothyroid patient. The sensitivity of the resin-strip method is not sufficient to allow separation of the low-normal elderly patient from the hypothyroid population, if sensitivity is defined as the smallest concentration of hormone distinguishable from zero. In addition, the T_3 concentration in the serum cannot be assumed to reflect thyroid status in patients with severe liver disease (*5*). As the liver is the major site of extrathyroid deiodination of T_4 to T_3, patients with severely com-