Hyperthyroidism with Normal Values for Total Thyroxin in Serum, Pirjo Nuuttila,1 Kerttu Iriola,2 Hanna-Leena Kaihola,2 Pentti Seppälä,2 and Jorma Viikari3 (1 Dept. of Med., 2 Central Lab., Univ. Central Hospital of Turku, SF-20520 Turku, Finland)

We assessed the frequency and clinical background of normal concentrations of serum total thyroxin (T4) found among 84 hyperthyroid patients out of 633 consecutive patients evaluated for suspected hyperthyroidism. Patients were categorized as having hyperthyroidism if they had hyperthyroid symptoms and signs, had a serum thyrotropin (TSH) <0.1 milli-int. unit/L as measured by immunoradiometric assay (Farmos Diagnostica, Turku, Finland), and needed treatment.

Serum total T4 determined with a radioimmunoassay (Farmos Diagnostica; reference interval 70–150 nmol/L) was normal in 17 hyperthyroid subjects among 68 patients (25%) without previous thyroid history (Figure 1). Normal T4 values were common in patients with nodular goiter (34.8%, eight of 23), but seldom found in cases of Graves’ hyperthyroidism (10.5%, four of 38). Moreover, normal T4 values were more common in relapsed clinical disease than in newly diagnosed cases (chi-square = 8.18, P < 0.01). Results for all 84 hyperthyroid patients were as follows:

![Graph showing relationship between T4 and FT4 concentrations in sera of hyperthyroid subjects.](image)

**Fig. 1.** Total T4 and free T4 concentrations in sera of hyperthyroid subjects

**Dotted lines:** normal reference values for T4 and FT4. □ patients without previous thyroid history; △ patients with relapsed disease

References


Analysis of whole blood for cyclosporine with the TDx clinical analyzer (Abbott Labs., Abbott Park, IL) involves a monoclonal antibody and fluorescence polarization immunoassay technology. We compared results of this procedure with the results of a liquid-chromatographic procedure (1, 2) for 224 blood samples collected from 10 patients being treated with Sandimmune™ (cyclosporine) after orthotopic liver transplantation. At least 20 samples collected during the first 90 days post-transplant were obtained from each patient. Treatment of patients followed a clinical protocol described elsewhere (3). All specimens were collected and analyzed by liquid chromatography (HPLC) for routine clinical monitoring on the same day as collected, and the residual sample was subjected to the Abbott procedure. Some of the samples (10%) were analyzed by both procedures within one day; the rest were stored at 4 °C for at least one day (but no more than 15 days) before analysis by the Abbott procedure.

The Abbott monoclonal assay of cyclosporine in whole blood was carried out similarly to the whole-blood polyclonal assay (4), as has been described elsewhere (5). Blood was treated with a solubilizing agent containing surfactant and a protein-precipitating reagent (zinc sulfate in metha-
Figure 1 shows the correlation of whole-blood cyclosporine results derived by HPLC analysis and by the monoclonal TDx assay. The within-run coefficient of variation (CV) was 0.7% at 156 µg/L, 1.2% at 398 µg/L, and 2.4% at 803 µg/L. Between-run (n = 34) CVs for data collected over three months were 5.2% at 145 µg/L, 3.2% at 385 µg/L, and 2.3% at 771 µg/L. Calibration standards for the HPLC assay (50, 250, and 500 µg/L) yielded average results of 52, 256, and 501 µg/L, respectively, when analyzed by the TDx assay on two separate occasions. Calibrators prepared by Abbott for the monoclonal fluorescence polarization procedure (0, 10, 100, 250, 500, 1000, and 1500 µg/L) yielded average results of 26, 87, 228, 480, 960, and 1478 µg/L, respectively, by the HPLC assay on two separate occasions. The HPLC result for the zero Abbott calibrator is at the limit of sensitivity of the HPLC assay (i.e., the result is questionable). Otherwise, the apparent negative bias of 4% in the TDx calibrators as measured by HPLC is not sufficient to explain the positive slope observed in the regression analysis.

Relationships between whole-blood concentrations of cyclosporine measured by immunoassay techniques incorporating monoclonal antibodies compared with liquid chromatography range in slope from 1.0 (7, 8) to >1.6 (9, 10). According to data presented at the Consensus Conference on Cyclosporine (11), many laboratories have observed a bias ranging from 10% to 20% for results by whole-blood monoclonal immunoassay techniques compared with those by liquid chromatography, the "standard" method.

We conclude that measurement of whole-blood cyclosporine by fluorescence polarization technology with a monoclonal antibody performed with the Abbott TDx analyzer correlated well with results derived by liquid chromatography. The positive bias of 19% for the immunoassay results is consistent with that of other monoclonal immunoassay techniques for measuring cyclosporine in whole blood.

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References