# Symposium

## Present Status of RI Diagnosis of Thyroid Diseases

### In Vitro Thyroid Function Tests

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Many different types of in vitro thyroid function tests have been established and are being utilyzed in many laboratories. It would be, therefore, very important to examine the conditions of in vitro thyroid function tests in various laboratories in Japan. In this presentation, the results of the control survey of $T_3$-uptake, serum $T_4$ and free $T_4$determination, serum $T_3$and serum TSH measurements is described.

Three types of the samples in each assay system were sent to 123 laboratories for the survey. In $T_3$-uptake, serum $T_4$ and serum free $T_4$determinations, Sample A included 1% charcoal-treated serum and normal serum collected from 12 euthyroid subjects. Sample C was a normal serum added 10 ug/100 ml of $T_4$. In $T_3$ and TSH assay, Sample A and Sample B were the same as those in $T_4$determination, and in Sample C, 3ng/ml of $T_3$ and 50 uU/ml of TSH were added to normal seru respectively. 109 laboratories among 123 (88.6%) collaborated to measure the samples.

$T_3$-uptake was carried out by Triosorb, Res-O-Mat-$T_3$, Thyopac-3 and Trilute kit. Deviations of values in each sample varied according to the amount of $T_4$ in samples and to the kit employed, and were 7.1% (A), 6.8% (B), 5.5% (C) in Triosorb, 3.8% (A), 3.0% (B), 3.8% (C) in Res-O-Mat-$T_3$ and 1.6% (A), 2.0% (B), 2.5% (C) in Thyopac-3. In serum $T_4$ determinations using Tetrasorb, Res-O-Mat-$T_4$, Thyopac-4 and Tetralute, deviations were 15.0% (A), 12.2% (B), 15.4% (C) in Tetrasorb, 24.0% (A), 19.8% (B), 12.4% (C) in Res-O-Mat-$T_4$ and 17.0% (A), 18.4% (B), 7.3% (C) in Thyopac-4. Serum free $T_4$ determination showed the variations of 4.0% (A), 2.8% (B), 5.8% (C) in Res-O-Mat-ETR and 10.4% (A), 8.4% (B), 17.3% (C) in Quantesorb kit. The mean $\pm$SD of the results of serum $T_3$ assay from 29 laboratories were $0.44\pm0.08$ (A), $1.52\pm0.04$ (B) and $5.2\pm1.7$ ng/ml (C), and results of H-TSH assay from 30 laboratories averaged $2.5\pm1.6$(A), $3.2\pm1.6$ (B) and $60.9\pm36.0$ uU/ml respectively.

In most of the assay system, deviations among laboratories were much greater than the interassay variations in a given laboratory. The difference seems to be due to a small difference in technique how to perform the assay by each kit.

It is, therefore, necessary to make a more detailed instraction for each kit. The accuracy of the determination in each kit should be more emphasized than the technical simplicity.

## *In Vitro* Determinations of Serum Thyroid Hormones, Thyroid Stimulating Hormone and Binding Capacity of Thyroxine-Binding Proteins and Their Clinical Applications

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Serum triiodothyronie ($T_3$) and thyroxine ($T_4$) were measured by radioimmunoassay method. Binding capacities of $T_4$-binding globulin (TBG) and $T_4$-binding prealbumin (TBPA) were measured by the method of Tanaka and Starr and polyacrylamide gel electrophoresis. Serum TSH was measured by the double-antibody radioimmunoassay method. Serum protein-bound and free $^{125}$I-$T_4$ and $^{125}$I-$T_3$ were separated with sephadex G-25 columnchromatography. Ratio of the net count of free and protein-bound $^{125}$I-$T_4$ or $^{125}$I-$T_3$ was determined as percent free $T_3$ or $T_4$. Serum free $T_4$or $T_3$ values was calculated by multiplying the serum total and percent of free $T_4$ or $T_3$.

Both binding capacities of TBG and TBPA were decreased in hyperthyroidism and increased in hypothyroidism. These values became normal ones by the treatment with antithyroid drugs, $^{131}$I and thyroid hormomes. Binding capacity of TBPA in a patients of decreased TBG was inclined to be higher than normal value.

Serum total $T_4$ and $T_3$ values of TBG-deficient patients were higher than normal ones, but free $T_4$ and $T_3$ values of them were normal.

When 0.24 mg of ethinylestradiol-3-methylester was administered orally for 14 days to a TBG-deficient patient, binding capacity of TBG unchanged.

In 15 cases of breast cancer, mean basal serum TSH value was significantly higher than normal one and overreacted to the stimulation of 500$\mu$g of TRH administered intravenously.

Mean normal value of urinary $T_3$ measured by radioimmunoassay was $0.59\pm0.28$ (S.D.) $\mu$g/24 hrs. $T_3$-clearance rate in hyperthyroidism calculated from serum free $T_3$, urinary $T_3$ and urinary volume was higher than normal one.

Urinary $T_4$ was extracted by columnchromatography of Dowex 50 W and measured by Tetrasorb Kit (Abbott Co.). Mean normal $T_4$ value was $9.8\pm0.56$ (S.D.) $\mu$g/24 hrs. $T_4$-clearance rate in hyperthyroidism calculated from serum free $T_4$, urinary $T_4$ and urinary volume was lower than normal one.