

# Thyroid Function and Volume in Patients with End-stage Renal Disease on Hemodialysis - Underlying Renal Diseases -

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## OBJECTIVES

In an earlier hospital-based study of 2,122 patients showed that the prevalence of primary hypothyroidism was higher in the patients with end-stage renal disease (ESRD) (2.6%) compared to a combined group of in- and out-patients (1.1%).

Hyperthyroidism is sometimes masked or overlooked in the ESRD patients even when with expected symptoms and signs including weight loss, tremor, atrial fibrillation or congestive heart failure. The prevalence of hyperthyroidism in the patients with ESRD was not significantly different from the general population.

It is controversial whether the incidence of goiter increases in patients with ESRD. A high incidence of goiter has been reported in ESRD patients in two hemodialysis centers located in the Switzerland and Denmark. In contrast, this was not found in two centers in the USA and England.

## METHODS

**Patients Selection:** The 145 patients (male/female; 84/61, age;  $60 \pm 15$  [19-93] years) had a mean duration of hemodialysis (HD) of  $80.7 \pm 70.8$  (1-368) months, dry weight  $53.1 \pm 12.8$  (32.0-107.5) kg. The thyroid function and thyroid gland volume (TV) of Japanese ESRD patients undergoing maintenance HD at Abe Clinic were examined in 82 (male/female; 45/37) cases of CGN, 30 (24/6) cases of DM, 12 (7/5) cases of HNT, and 5 (2/3) cases of PCKD.

**Ten Points Suggesting Hypothyroidism:** The signs and symptoms suggesting hypothyroidism was evaluated using hypothyroid score by the summation of the points such as; 1) dry skin, 2) cold intolerance, 3) hyperkeratosis, 4) constipation, 5) decreased exercise tolerance, 6) increased forgetfulness, 7) rough skin, 8) depressed ventilatory drive, 9) increased time required to fulfill a task, and 10) a low-pitched or hoarse voice. The ten points is the full score suggesting severe clinical hypometabolic state.

**Ultrasonographic Study:** Thyroid gland morphology was examined by ultrasonography using a frequency probe (8.5MHz Electronic Linear Probe, Aloka Co., LTD., Tokyo, Japan). The TV was measured as follow: TV (ml) = TV right (ml) + TV left (ml), TV right or left = long axis  $\times$  short axis  $\times$  thickness  $\times$  0.7 ml. As the normal range of TV is 16-20 ml in Japanese people, a "goiter" was defined as a TV > 20 ml.

**Statistical Analysis:** The data are expressed as mean  $\pm$  SD. Statistical differences were calculated by the one-way analysis variance and the unpaired t-test with the Dunnett method. Student's t-test was used for the comparison of two groups. A level of 0.05 was considered to be statistically significant.

Table 1. Clinical data and dialysis of the patients with end-stage renal disease on maintenance hemodialysis

	CGN 82	DM 30	HNT 12	PCKD 5
Age (year)	58 $\pm$ 14	61 $\pm$ 13	75 $\pm$ 10*	60 $\pm$ 12
Duration of HD(mo)	110 $\pm$ 79 <sup>†</sup>	40 $\pm$ 31*	42 $\pm$ 29*	74 $\pm$ 51
Dry weight (kg)	53 $\pm$ 12	56 $\pm$ 14	46 $\pm$ 9	58 $\pm$ 7
CTR (%)	49 $\pm$ 4	49 $\pm$ 5	52 $\pm$ 6*	46 $\pm$ 3
Cr (mg/dl)	12.3 $\pm$ 3.1*	10.8 $\pm$ 3.2*	8.2 $\pm$ 2.7*	12.6 $\pm$ 2.0
BUN (mg/dl)	77 $\pm$ 16	72 $\pm$ 16	71 $\pm$ 20	75 $\pm$ 11
Ca (mg/dl)	9.7 $\pm$ 0.9	9.0 $\pm$ 0.8	8.5 $\pm$ 0.7	9.5 $\pm$ 0.6
P (mg/dl)	5.9 $\pm$ 1.5	5.6 $\pm$ 1.4	4.8 $\pm$ 1.5	5.7 $\pm$ 1.0
i-PTH (pg/ml)	212 $\pm$ 171	168 $\pm$ 113	223 $\pm$ 117	166 $\pm$ 76
Kt/V	1.46 $\pm$ 0.28*	1.26 $\pm$ 0.23*	1.37 $\pm$ 0.27	1.27 $\pm$ 0.19

The data are expressed as mean  $\pm$  SD.

\* : P<0.05 compared with the data of CGN group.

<sup>†</sup> : P<0.05 between the CGN group and the DM, HNT, and PCKD groups.

CTR, cardiothoracic ratio in chest X-ray; Cr, creatinine; BUN, blood urea nitrogen; Ca, calcium;

P, phosphate; i-PTH, intact parathyroid hormone; Kt/V, urea kinetics; K, the whole-body

clearance rate of urea; t, effective treatment time; V, total body volume; and mo, months.

Table 2. Clinical thyroidal data of the patients with end-stage renal disease on maintenance hemodialysis

	CGN 82	DM 30	HNT 12	PCKD 5
Total Points	4.3 $\pm$ 2.5	5.0 $\pm$ 2.2	5.7 $\pm$ 1.9	4.5 $\pm$ 2.5
fT <sub>3</sub> (pg/ml)	2.18 $\pm$ 0.38	2.20 $\pm$ 0.53	1.99 $\pm$ 0.66	2.42 $\pm$ 0.48
fT <sub>4</sub> (ng/dl)	0.93 $\pm$ 0.17	0.99 $\pm$ 0.17	0.98 $\pm$ 0.13	0.95 $\pm$ 0.23
fT <sub>3</sub> /fT <sub>4</sub>	2.45 $\pm$ 0.68	2.25 $\pm$ 0.44	1.95 $\pm$ 0.66*	2.59 $\pm$ 0.35
TSH (mU/l)	4.2 $\pm$ 10.4	2.6 $\pm$ 2.2	3.0 $\pm$ 2.5	4.2 $\pm$ 2.7
Tg (ng/ml)	60 $\pm$ 98*	24 $\pm$ 17*	25 $\pm$ 21	22 $\pm$ 15
TV (ml)	14.6 $\pm$ 6.0	16.5 $\pm$ 6.6	11.0 $\pm$ 2.9*	10.7 $\pm$ 2.6
TC (mg/dl)	159 $\pm$ 35	152 $\pm$ 35	145 $\pm$ 32	169 $\pm$ 35
CPK (mg/dl)	108 $\pm$ 94	87 $\pm$ 49	75 $\pm$ 41	74 $\pm$ 19

The data are expressed as mean  $\pm$  SD.

\* : P<0.05 compared with the data of CGN group.

<sup>†</sup> : P<0.05 compared between the CGN group and the DM, HNT, and PCKD groups.

fT<sub>3</sub>, free triiodothyronine; fT<sub>4</sub>, free thyroxine; TSH, thyroid-stimulating hormone;

Tg, thyroglobulin; TV, thyroid gland volume; TC, total cholesterol;

and CPK, creatine phosphokinase.

## RESULTS

Apparent thyroid dysfunction was suggested as follows; thyrotoxicosis in 2 (1.4%), hypothyroidism in 25 (17.2%), and low T<sub>3</sub> syndrome in 23 (15.9%) of the patients.

The prevalence of hypothyroidism compared with reference values for the ESRD patients (TSH > 5.5 mU/l) was high in the CGN group (8/145, 5.6%), while only one patient (0.7%) in the DM group, were in hypothyroid state.

fT<sub>3</sub>/fT<sub>4</sub> was low in the HNT group.

The ultrasonographic TV was examined and the TV of all patients was  $14.3 \pm 5.9$  ml. Although goiter was observed in 22 patients (15.2%), the number of CGN was 13 patients (9.0%), DM 6 patients (4.2%), and HNT or PCKD 0 patient (0%).

## CONCLUSIONS

The prevalence of thyrotoxicosis was 2 patients (1.4%) and hypothyroidism 25 patients (17.2%).

Hypothyroidism was more frequent in CGN (8 patients, 5.6%), but in DM (1 patients, 0.7%).

fT<sub>3</sub>/fT<sub>4</sub> was low in HNT.

The goiter was observed in 22 patients (15.2%).

The TV was the smallest in HNT.

## References

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