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Prevalence of Nodular Goiter and Hypothyroidism in Chronic Hemodialysis Patients: A Cross Sectional Study in South India

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ABSTRACT

Introduction: Patients with ESRD with hypothyroidism are more susceptible to cardiovascular disease, with an increased risk of mortality than those with normal thyroid function. Moreover, these patients have higher incidence of benign and malignant nodules. The present study was designed to evaluate the thyroid function tests, prevalence of nodular goiter and hypothyroidism in hemodialysis patients in Kerala state compared with normal population.

Materials and Methods: This cross-sectional study was conducted in the department of medicine at Mount Zion Medical College, Pathananamthitta, Kerala India. Ninty eight patients were selected for the study. Thyroid gland was evaluated by physical examination and ultrasonography. Blood level of FT3, FT4, TSH, TPO Ab, and urinary iodine excretion were checked in both groups. Data were analyzed using SPSS-19 and P-value less than 0.05 was considered as the significance level.

Result: Goiter was demonstrated by physical examination in 28.5% of the HD patients versus 14.3% of the control groups (p=0.04) In addition, nodular goiter shown by ultrasonography was found in 26.5% of the HD patients versus 3.1% of the control groups (P=0.01). There was no correlation between goiter and PTH, HCT, Alb, Ca, and erythropoietin use and duration of HD (P>0.05).

Conclusion: We recommend screening for thyroid dysfunction and goiter using appropriate tests and sonography should be considered especially hypothyroid patients with nodules who are at higher risk of cardiovascular complications and cancer and who should receive stricter monitoring.

KEYWORDS: Hypothyroidism, Nodular Goiter, Hemodialysis.

INTRODUCTION

Hypothyroidism is the most common disorder arising from thyroid hormone deficiency.[1] Subclinical hypothyroidism is defined by a high serum concentration of thyroidstimulating hormone (TSH) with normal levels of free triiodothyronine (FT3) and tetraiodothyronine (FT4).Thyroid nodular disease and differentiated thyroid carcinoma have also been regarded as a possible new spectrum of IR.[2] It has been suggested that subjects with hyperinsulinemia may present greater thyroid size and greater prevalence of nodules.[2] This finding is in accordance with reported studies from patients with acromegaly, in which the prevalence of goiter and nodules was found to be greater, probably as a result of the increased activity of IGF-1.[3] Elevated prevalence of IR in patients with differentiated thyroid carcinoma has also been demonstrated.[4]

goiter is defined as a thyroid gland that is larger than the upper limit of normal for the patient's age and sex: 18 mL for women, 25 mL for men. Goiter is a physical finding, not an illness in itself. It has many causes and can take on many shapes. Moreover, it can be associated with a euthyroid, hyperthyroid, or hypothyroid metabolic state. There is a substantial body of evidence to indicate the relationship between hypothyroidism and high

incidence of vascular, valvular and coronary artery calcification.[5,6] Low thyroid hormone levels (i.e. T3) have been associated with adverse cardiovascular sequelae in patients with chronic kidney disease and ESRD, but the underlying pathway involved remains largely unknown. It has been hypothesized that kidney disease may predispose to derangements of thyroid hormones due to nonthyroidal illness, malnutrition, inflammation, iodine retention, metabolic acidosis, medications, mineral deficiencies (e.g. selenium) and exposure to dialytic procedures (i.e. peritoneal effluent losses).[7-9]

Thyroid dysfunction can be correlated to the presence of structural abnormalities of the thyroid gland (diffuse goiter, multinodular goiter or single thyroid nodule). These changes may result from functional abnormalities or neoplasm. In patients with ESRD, benign and malign nodules are more common than in the general population.[10-12]

The present study was designed to evaluate the thyroid function tests, prevalence of nodular goiter and hypothyroidism in HD patients in Kerala state compared with normal population.

MATERIALS AND METHODS

This cross-sectional study was conducted in the department of medicine at Mount Zion Medical College, Pathananamthitta, Kerala India. Ninty eight patients were selected for the study. All participants had been dialyzed for at least 3 months before entering the study. The patients who had a history of thyroid disease or used anti-thyroidal drugs or levothyroxine, lithium, amiodarone or iodine were excluded from the study. Written and sighed consent were taken from every subjects and the study was approved by the local ethical committee of institution. The study In all patients, bicarbonate-based dialysate fluid containing sodium (Na) 136 meq/L, potassium (K) 2 meq/L, Magnesium (Mg) 0.5 mmol/L, and calcium (Ca) 1.25 mmol/L was used. Blood and dialysate flow rates were 300–350 and 500 mL/min, respectively. It must be mentioned that those settings were the same for all patients during the HD session. None of these subjects had any known thyroid disease and none of them was on thyroid hormone supplementation and/or anti-thyroid drugs. Thyroid gland was palpated from the front. Goiter was defined as a visible thyroid gland on physical examination or when it was at least twice the expected size. Also, the thyroid gland was examined by ultrasonography using a real-time sonography device Logic 7 general electronic, USA with a 7.5 MHz linear high frequency transducer.

All those included in the study underwent estimations of serum total triodothyronine (TT3) and serum total thyroxin(TT4), serum thyrotrophin (TSH), and were performed by (T3 [1251] RIA kit REF: RK-6CTI), (T4 [1251] RIA kit REF: RK-5 CTI), (Turbo TSH [1251] IRMA kit REF: RK-ICTI) respectively; these systems provide direct quantitative in vitro administration of L-3,5,3- triodothyronine (T3), thyroxin (T4) and (TSH) human thyroid stimulating hormone in human serum. Patients who were on regular hemodialysis, sample of blood were taken before starting hemodialysis sessions to avoid art factual results caused by heparin. Hypothyroidism is characterized by a high serum TSH concentration (more than 5mIU/mL as our laboratory rang) and a low serum FT4 concentration (lower than 11.5mIU/mL as our laboratory rang). Subclinical hypothyroidism is defined as a normal serum FT4 and an elevated TSH.[13,14]

We used (SPSS) version 21.0 (Chicago, USA) for statistical analysis. Results of clinical and hormonal assessment of thyroid dysfunction obtained in patients with chronic renal failure were compared with those of the control group by statistical analysis using Chi-square test and t-test, p value < 0.005 considered significant.

Table 1: Clinical and biochemical characteristics of hemodialysis patients

Characteristics	Mean ± Standard deviation
Dialysis duration (months)	26.0±2.7
Systolic blood pressure	138.7±22.6
Diastolic blood pressure	86.28±1.9
Blood urea nitrogen (mg/dL)	55.7±13.5
Creatinine (mg/dL)	6.1±4.2
Serum sodium (meq/L)	134.0±8.5
Serum potassium (meq/L)	5.1±8.3
Serum calcium (mg/dL)	9.0±4.3
Serum phosphorous (mg/dL)	6.1±2.0
Hemoglobin (mg/dL)	10.9±7.9
Serum Iron	67.3±32.9
Total iron binding capacity.	301.6±74.8
Parathyroid hormone (pg/mL)	351.9±146.0

Table 2: Comparison the thyroid characteristics of the hemodialysis and control group

Characteristics	HD patients	Control group	P-value
Age (y, mean±SD)	52.6±12.7	53.2±13.9	0.452
FT3 (picomol/L, mean±SD)	2.6±0.32	4.9±2.7	0.031
FT4 (picomol/L, mean±SD)	12.9±6.3	13.2±1.6	0.428
TSH (micro IU/mL, mean±SD)	5.2±8.1	3.3±1.7	0.732
Anti Tpo (IU, mean±SD)	107.1±182.0	31.8±12	0.020
Urinary Iodide excretion (lgr/dL, mean±SD)	3.9±2.7	16.0±8.8	0.028
Goiter prevalence (n, %)	28(28.5%)	14(14.3%)	0.042
Nodular goiter prevalence (n, %)	26(26.5%)	3(3.1%)	0.010
Hypothyroidism prevalence [(TSH>5miu/mL and FT4<11.5pmol/L-n,%]	19(19.4%)	8(8.2%)	0.030

RESULTS

The mean age of the HD patients was 52.6±12.7 years and mean time on HD was 26.0±2.7 months. The clinical and biochemical data of HD patients are shown in Table 1. The most common cause of renal failure in HD patients was diabetes mellitus and the second cause was hypertension. The most common symptoms in HD patients with hypothyroidism were fatigue, constipation and the most common sign was HTN and goiter. The mean Systolic blood pressure was 138.7±22.6 and diastolic was 86.28±1.9 were recorded. The mean of Blood urea nitrogen (mg/dL) level was 55.7±13.5. Goiter was demonstrated by physical examination in 28.5% of the HD patients versus 14.3% of the control groups (p=0.04) In addition, nodular goiter shown by ultrasonography was found in 26.5% of the HD patients versus 3.1% of the control groups (P=0.01). There was no correlation between goiter and PTH, HCT, Alb, Ca, and erythropoietin use and duration of HD (P>0.05). Comparison the thyroid characteristics of the hemodialysis and control group were shown in table 2.

DISCUSSION

As widely recognized, goiter is the common denominator of many thyroid disorders, and is present in nearly 90% of untreated thyroid pathology, so that its detection encompasses a broad spectrum of thyroid diseases commonly found in the general population. Perhaps, the only subgroup of autoimmune thyroiditis that develops without goiter is a small part of its hypothyroid variant,[15] proving the single thyroid disorder that, in practice, is not detected in the monitoring modality carried out in this campaign. Lastly, the rare cases of hyperthyroidism of the elderly with normal thyroid palpation and, obviously, carriers of thyroid incidentalomas, could be added to the group of non-goiter patients.

In present study we found that the most common cause of renal failure in HD patients was diabetes mellitus and the second cause was hypertension. The most common symptoms in HD patients with hypothyroidism were fatigue, constipation and the most common sign was HTN and goiter. The mean Systolic blood pressure was 138.7±22.6 and diastolic was 86.28±1.9 were recorded. The mean of Blood urea nitrogen (mg/dL) level was 55.7±13.5. Goiter was demonstrated by physical examination in 28.5% of the HD patients versus 14.3% of the control groups (p=0.04) In addition, nodular goiter shown by ultrasonography was found in 26.5% of the HD patients versus 3.1% of the control groups (P=0.01). There was no correlation between goiter and PTH, HCT, Alb, Ca, and erythropoietin use and duration of HD (P>0.05). In previous studies, the prevalence of goiter in HD patients ranges from 0% in londen to 58% in Utah due to different methods of recognition of goiter.[16] Kaptein et al. reported the prevalence of goiter in ESRD patients was 43% versus 6.7% in the control groups. Kutlay et al. detected nodular goiter in 36.8% of the ESRD patients and 17.1% of the control groups.[17] Da Costa et al.'s study demonstrated a clear tendency for HD patients to present with more thyroid nodules compared to control group (24.1% vs. 7.9%); the difference was not statistically significant. 7 Patients with uremia have an increased thyroid volume compared with people with normal renal function and a higher incidence of goiter.[16,17] We found nodular goiter by ultrasonography in 26.5% of HD patients vs. 3.1% of the control group, which confirmed the most previous studies. Hypothyroidism may affect renal function through direct (glomerular and tubular changes) and indirect (hemodynamic changes) mechanisms.[18] In spite of the continuous improvement of dialysis technology and pharmacological treatments for ESRD, the impact of thyroid abnormalities on cardiovascular morbidity and mortality in renal patients has progressively emerged over the past decade.[19,20] The presence of hypothyroidism results in increased cardiovascular risk in patients with ESRD on a kidney transplant waiting list, a population with several cardiovascular risk factors.[19,21]

CONCLUSION

Thyroid hormone abnormalities, nodular goiter, and hypothyroidism are more common in HD patients

compared with controls. Otherwise, there was an association between hypothyroidism and mortality in ESRD patients, suggesting that this association may be managed by thyroid hormone supplementation. We recommend screening for thyroid dysfunction and goiter using appropriate tests and sonography should be considered especially hypothyroid patients with nodules who are at higher risk of cardiovascular complications and cancer and who should receive stricter monitoring.

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