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Evaluation of Thyroid Function in Patients of Chronic Renal Failure in Khartoum State – Sudan

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Abstract: ***Background: The functions of thyroid and kidney are interrelated, Various Studies of thyroid functions in uremic patients have been carried out which have shown conflicting results. Methodology: A matched case-control study was conducted in 50 patients with CRF and 50 healthy subjects, Patients were studied more than once (before and after Hemodialysis'' HD'') for Serum Triiodothyronine (T3), Serum thyroxin (T4) and Serum thyroid stimulating hormone (TSH). Parameters were measured by Enzyme Linked Immunosorbent Assay (ELISA). Results: the mean of T3 levels in cases was 75.40±25.05 ng/dl and in controls was 132.72±30.58 ng/dl. The mean of T4 level in cases was 5.77±1.40µg/dl and in controls was 7.96±1.71µg/dl. The mean of TSH level in cases was 4.78 ±2.24µIU /ml and in controls was 2.1±1.29 µIU /ml. The mean of T3 pre hemodialysis was 75.40±25.05 ng/dl and post hemodialysis was 81.8±22.42 ng/dl. The mean of T4 pre hemodialysis was 5.77±1.404 µg/dl and post hemodialysis was 6.17±1.446 µg /dl. The mean of TSH pre hemodialysis was 4.78±2.246 µIU/ml and post hemodialysis was 4.26±1.989 µIU/ml. Conclusion: The Means of T3, T4 were decreased, and that of TSH was increased significantly in cases compare to controls. The patients after HD show increment of T3 and T4 and reduced TSH if measured immediately after HD sessions.***

Keywords: Chronic renal failure (CRF), Hypothyroidism, Hemodialysis (HD).

1. Introduction

Chronic renal failure (CRF) is a state of irreversible deceleration in renal function. When only less than 10% of renal function remains, it termed as end stage renal disease, which classically develops over a period of years. Initially it manifests' only as a biochemical abnormality eventually loss of excretory, metabolic and endocrine functions of the kidney. This permanent loss of renal function culminates in signs and symptoms termed uremia [1]. This syndrome leads to death unless the toxins are removed by renal replacement therapy, using dialysis or kidney transplantation.

Chronic Renal Failure Cause many Endocrine consequences include increase PTH secretion, decrease testosterone and estrogens synthesis, and abnormalities of thyroid function tests (not usually associated with clinical thyroid disease, although the incidence of both goiter and primary hypothyroidism is significantly increased in CKD) [2]. Impaired renal clearance of iodine leads to elevated serum levels of inorganic iodide that potentially blocks thyroid hormone production resulting in Wolff Chaikoff‖ effect. Patients with CRF often have signs and symptoms suggestive of thyroid dysfunctions [3] - [4], a high percentage of them who are on hemodialysis therapy develop goiter and thyroid dysfunction [5] - [6].

Various studies of thyroid functions in uremic patients have been carried out which have shown conflicting results. Hyperthyroidism, hypothyroidism and euthyroid state have all been reported by various workers [6] - [7]. Serum Triiodothyronine(T3) levels were consistently found to be low, serum total and free thyroxin(T4) concentrations have been reported as low, normal or high. Serum thyroid stimulating hormone (TSH) levels were found to be normal in most of the patients of CRF even in those whose CRF was complicated by low T3 concentration[8].because of these variability in previous studies, a definite change in the thyroid hormone levels in CRF is yet to be determined. So study of thyroid hormone levels in CRF was taken.

2. Materials and Methods

A matched case-control study was conducted consisting of 50 patients with chronic renal failure (22 men and 28 women) with mean age of 40 ± 20 years, and 50 healthy volunteers (24 men and 26 women) with mean age of 40 ± 20 were taken as control subjects, all the subjects were asked to sign an informed consent prior to inclusion in the study.

Patients were studied more than once (before and after Hemodialysis). All patients were hemodialysis dependent for 4 months up to 6 years; hemodialysis was performed two times weekly each of 3 hours duration. In patients studied during maintenance Hemodialysis, blood was routinely sampled immediately before dialysis and one hour post dialysis.

Patient with known hypo or hyperthyroidism, history of thyroid or neck surgery, head trauma, patients on peritoneal dialysis, diabetes mellitus, liver diseases and drugs altering thyroid profile like amiodarone, phenytoin, beta-blocker, dopamine, steroids, estrogen pills and iodine containing drugs were excluded.

Components of thyroid profile included in this study serum Triiodothyronine (T3), serum thyroxin (T4) and serum thyroid stimulating hormone (TSH). Parameters measured by HUMAN semi automated Enzyme Linked Immunosorbent Assay (ELISA).

3. Results

Comparison of study parameters in cases and controls was shown in table 1. The Mean of T3 level in cases was 75.40±25.05 ng/dl and in controls was 132.72±30.58 ng/dl. The results of T3 in all 50 cases were decreased when compared to controls even though most of them were within the normal range. (P value <0.001) was statistically significant.

The mean of T4 level in cases was 5.77±1.40µg/dl and in controls was 7.96±1.71µg/dl. The results of T4 in all 50 cases were decreased even though most of them are within the normal range when compared to the controls, (P value <0.001) was statistically significant.

The mean of TSH level in cases was 4.78 ±2.24µIU /ml and in controls was 2.1±1.29 µIU /ml. the mean of TSH in cases was increased when compared to controls. (P value <0.001) was statistically significant.

Comparison of study parameters in patients of chronic renal failure pre and post hemodialysis was shown in table 2.The Mean of T3 level pre hemodialysis was 75.40±25.05 ng/dl and post hemodialysis was 81.8±22.42 ng/dl. The mean of T3 post hemodialysis was increased compared to pre hemodialysis. (P value <0.001) was statistically significant.

The Mean of T4 level pre hemodialysis was 5.77±1.404 µg/dl and post hemodialysis was 6.17±1.446 µg /dl. The mean of T4 post hemodialysis was increased compared to pre hemodialysis. (P value <0.001) was statistically significant.

The mean of TSH level pre hemodialysis was 4.78±2.246 µIU/ml and post hemodialysis was 4.26±1.989 µIU/ml. the mean of TSH post hemodialysis was slightly decreased compared to pre hemodialysis. (P value <0.001) was statistically significant.

Table 1: Comparison of study parameters in cases and controls (Mean, SD)

Variable		Mean	Std. Dev	P value
T3 (ng/dl)	Cases	75.4	25.05	<0.001
	Controls	132.72	30.58	
T4 (µg/dl)	Cases	5.77	1.404	<0.001
	Controls	7.96	1.71	
TSH (µIU/ml)	Cases	4.78	2.246	<0.001
	Controls	2.1	1.29	

Table 2: Comparison between Pre and Post Hemodialysis. (Mean , SD)

Variable		Mean	Std. Dev	P value
T3 (ng/dl)	Pre HD	75.4	25.05	<0.001
	Post HD	81.8	22.42	
T4 (µg/dl)	Pre HD	5.77	1.404	<0.001
	Post HD	6.17	1.446	
TSH (µIU/ml)	Pre HD	4.78	2.246	<0.001
	Post HD	4.26	1.989	

4. Discussion

A large number of hormonal systems are affected by CRF, yet it remains unclear to what extent these changes are responsible for manifestations of uremic syndrome. The data reported deals primarily with the clinical symptoms sign index & biochemical parameters.

Serum T3 concentration was less than the reference range in 4 of the 50 patients with chronic renal failure (8%). The mean serum T3 concentration of (75.40±25.05 ng/dl) in patients with chronic renal failure group was significantly (P value <0.001) lower than that in control subjects (132.72±30.58). Reduced T3 levels due to decreased peripheral conversion of T4 to T3, while thyroid gland production of T3 is normal and T3 clearance rates are normal or decreased, as in other nonthyroidal illness [9].

Serum T4 concentration was less than the reference range in 6 of the 50 patients with chronic renal failure (12%). The mean serum T4 concentration of (5.77±1.40µg/dl) in patients with chronic renal failure group was significantly (P value <0.001) lower than that in control subjects (7.96±1.71). Reduced T4 levels due to renal insufficiency may be secondary to low serum albumin & pre-albumin [8]. The reduction in T4 is attributed to the presence of circulating inhibitors, which impairs binding of T4 to thyroxin binding globulin [10].

Serum TSH concentration was more than the reference range in 12 of the 50 patients with chronic renal failure (24%).The mean serum TSH concentration of (4.78 ±2.24µIU /ml) in patients with chronic renal failure group was significantly (P value <0.001) higher than that in control subjects (2.1±1.29). increased TSH in those patients who had low T3 and T4 suggesting maintenance of pituitary thyroid axis [7] - [11].

Study findings were in agreement with other studies that reported that serum total T3 and T4 concentrations were significantly higher and TSH was decreased immediately after a hemodialysis session than before [12] – [13] – [14]. Correction of metabolic acidosis improves thyroid hormones axis in hemodialysis patients and may also lower morbidity and mortality [15].

5. Limitations

Study has certain limitations, such as low number of cases, lack of correlation with GFR and the duration of hemodialysis, and it was not linked with specific age group or gender that might be the issue of a future separate study.

6. Conclusion

From above study finally concluded that the mean of T3, T4 was decreased , TSH increased significantly in cases compared to controls, and patients undergoing regular HD show increment of T3, T4 and reduced TSH if measured immediately after HD sessions.

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