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Thyroid Dysfunction in Chronic Kidney Disease

KEYWORDS: Chronic renal Failure, Free T3 , Free T4 , TSH

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ABSTRACT *The study was designed to assess the thyroid dysfunction in ckd patients which will helpful in determining the prognosis of patients.60 cases and 40 healthy subjects (controls) were included in the study at asram medical college.In all these subjects serum concentration of urea, creatinine, freeT3, free T4 and TSH were measured.There was significant reduction in serum free T3 and freeT4 in cases as compared to controls(p<0.0001). There was no significant increase in serum level of TSH in cases as compared to controls(p =0.1323). From this study it was observed that chronic kidney disease is associated with low thyroid function.*

INTRODUCTION:

Chronic kidney disease is a major cause of morbidity and mortality, particularly at the later stages.[1] Chronic renal failure(CRF) corresponds to chronic kidney disease (CKD) stages 3 – 5.[2] There is a relation between thyroid hormones and kidney.Chronic kidney disease affects both hypothalamus-pituitary-thyroid axis and thyroid hormone peripheral metabolism.[3,4,5,6] There are various studies regarding the status of thyroid hormones in CKD, but in our study we have found the importance of free thyroid hormones.

MATERIALS AND METHODS:

Sixty cases with chronic renal failure of various age groups from 30-60 years were selected for the study. Patients with thyroid diseases,patients with known consumption of oestrogen, corticosteroid, iodine containing drugs,pregnant women,acute renal failure were excluded from the study.40 healthy persons of same age group were taken as controls. They did not suffer from any renal disease and renal function tests were in the normal limits. Blood samples were collected without addition of anticoagulant from the outpatients as well as inpatients. Serum was separated for the estimation of parameters. Blood Urea was estimated by Urease Glutamate Dehydrogenase method[7],Serum Creatinine by Jaffe's method[8,9],serum fT_3 by Competitive ELISA[10,11,12], serum fT_4 by Competitive ELISA[13,14,15],serum TSH by Sandwich ELISA[16,17,18].

RESULTS:

The results obtained in this present study were from a total number of 100 subjects. These 100 subjects have been divided into,Group-1containg Controls (n=40),Group-2 containing CRF cases(n=60) .CRF cases based on the type of treatment taken were further subdivided into Group2a-included patients on conservative treatment (n=25),Group 2b-patients undergoing hemodialysis (n=35).The results are shown in Table-1, Table-2. Statistical analysis was done by unpaired student's t test.

Table-1:

TABLE- 1 Comparision of serum Urea,Creatinine, fT_3, fT_4,TSH between CRF cases and controls

Groups	Urea mg/dl	Creatinine mg/dl	fT_3 (pg/ml)	fT_4 (ng/dl)	TSH mIU/L
Controls Mean±SD	21.98±6.93	0.87±0.19	2.038±0.575	1.364±0.319	2.74±0.94
Cases Mean±SD	99.22±46.46	6.63±3.10	1.114±0.753	1.096±0.191	3.81±5.34
SEM	6.068	0.401	0.1331	0.0246	0.705
t-value	12.67	14.35	-6.94	-4.77	1.52
P- value	<0.0001	<0.0001	<0.0001	<0.0001	0.1323
Inference	Highly significant	Highly significant	Highly significant	Highly significant	Not significant

Table-1 shown that the serum levels of urea, creatinine were significantly increased and serum levels of fT_3,fT_4 were significantly decreased in cases but no significant change in serum TSH was observed in cases as compared to controls.

Table-2 :

TABLE-2 Comparison of Thyroid hormones status between patients on conservative treatment & hemodialysis

Groups	No.of Cases	Serum f T_3(pg/ml)	Serum f T_4(ng/dl)	Serum TSH (mIU/L)
Conservative Treatment Mean ± SD	25	1.096 ±0.757	1.067 ±0.179	4.28 ± 5.94
Hemodialysis Treatment Mean± SD	35	1.126±0.760	1.117±0.198	4.20 ± 6.65
SEM		0.1986	0.0491	1.637
t-value		-0.15	-1.02	0.05
p-value		0.8832	0.3121	0.9612
Inference		Not significant	Not significant	Not significant

Tale-2 shown that there was no significant change of serum fT_3, fT_4 and TSH in patients on conservative treatment and hemodialysis.

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DISCUSSIONS:

The levels of serum urea was significantly higher in cases when compared to controls ($p<0.0001$). In chronic renal failure as the number of functioning nephrons are gradually reduced, urea excretion could be impaired and its concentration in the blood rises . The levels of serum creatinine was significantly higher in cases when compared to controls ($p <0.0001$). In chronic renal failure as the functioning nephrons are reduced, creatinine excretion could be impaired and its concentration in the blood rises. Creatinine level in serum appears to be a better index of the severity of the degree of failure in patients suffering from chronic renal failure, while serum urea concentration shows a better correlation with degree of failure in acute renal failure.[19] The serum level of free T_3 was significantly low in cases as compared to controls ($p<0.0001$) (Table -1).This reduction in T_3 levels is the most frequent thyroid alterations observed in these patients.[20,21,22,23,24]This reduction in free T_3 concentration has been linked to impairment in deiodination of T_4, a principal process by which T_3 is produced at peripheral levels.[25] Chronic metabolic acidosis associated with the CKD may contribute in this effect. The present study data is in accordance with Iglesias P and Diez JJ[26], Elaine may kaptein[5], A. Gomez Pan, F. Alvarezude, P.P.B. Yeo, R. Hall, D.C. Evered, D.N.S. Kerr.[27] The serum free T_4 level was significantly low in cases as compared to controls ($p<0.0001$) (Table-1). Almost all the circulating T_4(99.98%)is bound to thyroid hormone binding globulin(TBG) and to a lesser extent, to prealbumin and albumin. Although circulating TBG and albumin levels are typically normal in uremia, retained substances in renal failure may inhibit hormone binding to these proteins. This inhibition explains, why patients with chronic renal failure have low serum T_4 levels.[27] The serum TSH level in cases was not significantly increased ($p = 0.1323$) as compared to controls. The normal TSH is due to its inhibited response to its releasing hormone (TRH).[20,28,29,24] These findings suggest the presence of intrathyroidal and pituitary distrubances associated with uremia.[29] The inhibited response is due to TSH glycosylation and TSH circadian rhythm being altered in chronic kidney disease which may compromise TSH bioactivity. Statistically the data showed no significant changes in the thyroid hormones status in patients on conservative treatment & hemodialysis ($p>0.05$) (Table-2). Kayima JK, Otieno LS, Gitau W, Mwai S[30] showed same findings in their study. In patients undergoing hemodialysis,

all the thyroid function tests showed improvements, which indicated that hemodilution and a decrease in the T_4 – binding affinity of thyroid binding globulin with thyroid hormones were the major factors in the low thyroid hormone levels in CRF patients.[31]

CONCLUSION:

From the present study it is established that chronic kidney disease is associated with disturbances in thyroid function characterized by low serum free T_3 and free T_4 but normal serum TSH and patients are clinically euthyroid.

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