

Evaluation of Thyroid Function Tests among Chronic Kidney Disease Patients attended at a Tertiary Care Hospital in Dhaka City

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Abstract

Background: Serological status of thyroid hormones is important among chronic kidney disease patients. **Objective:** The purpose of the present study was to see the status of thyroid hormones among chronic kidney disease patients. **Methodology:** This cross-sectional study was done From January 2013 to December 2013 in the Department of Nephrology, Dhaka Medical College Hospital. A total of 50 diagnosed cases of adult male with different stages of CKD (CKD stage 3, 4, 5 and 5D) patients along with age-matched 51 healthy individuals were included. Serum Thyroid hormone T3 done by [125I] RIA kit, T4 done by T4 [125I] RIA kit, TSH level done by Turbo TSH [125I] IRMA kit. **Result:** A total number of 101 patients were recruited for this study of which 51 cases were in the group A and the rest of the 50 cases were in the group B. The mean serum T3 level was found 1.85 ± 0.7 nmol/L in group A and 2.79 ± 0.55 nmol/L in group B ($p < 0.05$) which indicated that low serum T3 level was significantly associated with CKD. The mean serum T4 level was found 104.65 ± 34.9 nmol/L in group A and 138.8 ± 31.5 nmol/L in group B ($p < 0.05$). Serum TSH level of the study patients showed that the mean serum TSH level was found 4.23 ± 4.6 mIU/L in group A and 2.06 ± 2.5 mIU/L in group B ($p < 0.05$). **Conclusion:** In conclusion the mean with SD of serum level of T3, T4 and TSH were significantly associated with chronic kidney disease. [Journal of National Institute of Neurosciences Bangladesh, July 2022;8(2):147-151]

Keywords: Evaluation; thyroid function tests; chronic kidney disease

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Introduction

The thyroid hormones are essential for proper development and differentiation of all cells of the human body¹. These hormones also regulate protein, fat, and carbohydrate metabolism, affecting how human cells use energetic compounds². Impairment in kidney function leads to disturbed thyroid physiology, including

alterations in hormone production, distribution, and excretion, epidemiologic data suggests that predialysis patients with chronic kidney disease have an increased risk of hypothyroidism; many cases are sub clinical³. 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^{4,6}. Serum triiodothyronine (T3) levels were consistently found to be low without any regard to treatment of CKD patients⁷. 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 patients of CKD even in those whose CKD is complicated by low T3 concentration⁸. This peculiar hormonal profile, however, not associated with increased conversion of T4 to the metabolically inactive reverse T3 (rT3) because plasma rT3 levels are typically normal in uremia. This finding differentiates the uremic patients from patients with other chronic illnesses⁹.

The study of thyroid functions of CKD patients' helps early recognition of these adverse conditions, thus specific actions may be taken earlier, may halt or retard the adverse situations. Moreover a very sparse data is yet available about thyroid status of CKD patients in our country and variability of thyroid function tests in patients with CKD in previous studies. This present study was undertaken to see the status of thyroid hormones among chronic kidney disease patients.

Methodology

This cross sectional study was done From January to December, 2013 in the Department of Nephrology, Dhaka Medical College Hospital. A total of 50 diagnosed cases of adult male with different stages of CKD (CKD stage 3, 4, 5 and 5D) patients (with estimated glomerular filtration rate (eGFR) 30-59 ml/min, 15-29 ml/min, <15 ml/min without dialysis), according to MDRD formula respectively, stage 5D on maintenance hemodialysis along with age matched 51 healthy individuals were included. Serum Thyroid hormone T3 done by [125I] RIA kit, T4 done by T4 [125I] RIA kit, TSH level done by Turbo TSH [125I] IRMA kit. A standardized questionnaire was used to collect demographic data, age at diagnosis of CKD and clinical presentation and findings. Patients giving history of thyroid disease, patients of type-1 diabetes mellitus, patients taking steroid, oestrogen or having history of taking iodine containing medication, patients age less than 18 or more than 65 years were excluded from the study. Diagnosis of CKD was confirmed by history, clinical examination, biochemical findings and imaging. All CKD patients were designated as group 'A', healthy control group were grouped as group 'B'. Clinical and biochemical finding of the CKD patients (group A) was compared with that of the healthy control group (group B), patients also divided into two groups, dialysis and pre dialysis, comparison between

dialysis and pre dialysis group and between different stages of CKD was also be done.

Data processing and data analysis: Data was processed and analyzed using computer software SPSS (Statistical Package for Social Sciences). The test statistics to be used for analysis of data are ANOVA test, Student's t-test (for comparison of data presented in quantitative scale), Chi-square Test or Fisher's Exact Probability Test (for comparison of data presented in categorical scale). For any analytical test the level of significance is 0.05 and p-value < 0.05 was considered significant.

Results

A total number of 101 patients were recruited for this study of which 51 cases were in the group A and the rest of the 50 cases were in the group B. It was observed that the mean age was found 43.76±13.1 years in group A and 45.96±13.2 years in group B (p>0.05) (Table 1).

Table 1: Distribution of the Study Subjects by Age (n=101)

Name of Group	Mean±SD	P value
Group A	43.76±13.1	
Group B	45.96±13.2	0.05

P value was measured by unpaired t-test

It was observed that majority patients had normal serum T3 level in both groups which was 40(78.4%) cases and 48(96.0%) cases in group A and group B respectively. Below normal serum T3 level was found in 21.6% cases only in group A. The mean serum T3 level was found 1.85±0.7 nmoL/L in group A and 2.79±0.55 nmoL/L in group B. The difference was statistically significant (p<0.05) between two groups which indicated that low serum T3 level was significantly associated with CKD (Table 2).

Table 2: Distribution of the Study Subjects by Serum T3 level (n =101)

Serum T3 (nmol/L)	Group A	Group B	P value
Low	11(21.6%)	0(0.0%)	0.001*
Normal	40(78.4%)	48(96.0%)	0.008*
High	0(0.0%)	2(4.0%)	-
Total	51(100.0%)	50(100.0%)	
Mean ± SD	1.85±0.7	2.79±0.55	0.001**
Range (Min–Max)	0.66 to 3.2	1.38 to 4.2	

*P value was measured by unpaired t-test; **P value was calculated Chi-square test; Normal Value=1.23 to 3.54; Low value=Less Than 1.23; High value=More Than 3.54

Serum T₄ level of the study patients shows that majority patients had normal serum T₄ level in both groups, which was 49(96.1%) in group A and 46(92.0%) in group B. The mean serum T₄ level was found 104.65±34.9 nmol/L in group A and 138.8±31.5 nmol/L in group B. The mean difference was statistically significant ($p < 0.05$) between two groups (Table 3).

Table 3: Distribution of the study subjects by serum T₄ level (n =101)

Serum T ₄ (nmol/L)	Group A	Group B	P value
Less Than or Equal to 54	11(21.6%)	0(0.0%)	0.001*
55 to 173	40(78.4%)	48(96.0%)	0.008*
More Than 173	0(0.0%)	2(4.0%)	-
Total	51(100.0%)	50(100.0%)	
Mean ± SD	1.85±0.7	2.79±0.55	0.001**
Range (Min–Max)	0.66 to 3.2	1.38 to 4.2	

*P value was measured by unpaired t-test; **P value was calculated Chi-square test

Serum TSH level of the study patients showed that the mean serum TSH level was found 4.23±4.6 mIU/L in group A and 2.06±2.5mIU/L in group B. The mean serum TSH level difference was statistically significant ($p < 0.05$) between two groups (Table 4).

Table 4: Distribution of the Study Subjects by Serum TSH level (n =101)

Serum TSH (mIU/L)	Group A	Group B	P value
Less Than 0.3	1(1.96%)	1(2.0%)	0.747*
0.3 to 5	40(78.4%)	47(94.0%)	0.023*
More than 5 to 10	6(11.8%)	1(2.0%)	0.053*
More than 10	4(7.8%)	1(2.0%)	0.187*
Total	51(100.0%)	50(100.0%)	-
Mean± SD	4.23±4.6	2.06±2.5	0.004**
Range (Min–Max)	0.23 to 23.5	0.29 to 17.8	-

*P value was measured by unpaired t-test; **P value was calculated Chi-square test

Discussion

In this study a total of 101 clinically diagnosed cases of CKD patients of different stages, age and sex match controls in Nephrology department of Dhaka Medical College and Hospital (DMCH), Dhaka, during January 2013 to December 2013, were included in this study. In this series it was observed that the mean age was found 43.76±13.1 years varied from 18 to 65 years in group A (CKD patients) and 45.96±13.2 years varied from 20 to 65 years in group B (healthy controls), which was almost alike between two groups. Similarly, Malik⁸ and

Lo et al² showed the mean age was 40 years with range from 21 to 65 years and 48.7±18.9 years respectively, which are consistent with the current study. On the other hand Carrero et al¹⁰ and Chonchol et al³ found the mean age was found 55 years varied from 19 to 70 years and 54.9±16.2 years varied from 18 to 94 years. The higher mean age obtained by the above authors maybe due to increased life expectancy, geographical and racial influences may have significant impacts on CKD patients.

In this series it was observed that below normal S. T₃ level found in 21.6% only in group A, majority patients had normal serum T₃ level in both groups, which was 40(78.4%) in group A and 48(96.0%) in group B. The mean serum T₃ level was found 1.85±0.7 nmol/L varied from 0.66 to 3.2 nmol/L in group A and 2.79±0.55 nmol/L varied from 1.38 to 4.2 nmol/L in group B, that was significantly ($p < 0.05$) lower in patients having CKD with compared to control, which indicate that low serum T₃ level was significantly associated with CKD. Avasthi et al¹¹ have showed the mean value of serum T₃ level was significantly less in patients of CKD as compared to controls (patients of CKD 0.80±.25ng/ml, controls 1.12±.17ng/ml; $p < 0.05$). Nearly a half (46.67%) of the CKD patients have serum T₃ less than 0.8ng/ml, whereas none of the control group have serum T₃ concentration below the normal range. The mean values of both serum T₃ and T₄ were significantly low mentioned by the authors. This is comparable with the studies done earlier by Ramirez et al¹², Lim et al¹³, Paqualini et al¹⁴, Pagliacci et al¹⁵. The likely explanations for low levels of both T₃ & T₄ could be defective release in response to TSH. On studying FT₄ concentration in patients of CKD, 33.0% had low FT₄ concentrations (less than 0.6 ng/ml) compared to none of the controls and was comparable to studies done by Pagliacci et al¹⁵ and Hardy et al¹⁶. In another study, Carrero et al¹⁰ mentioned that the novelty of the present analysis is that low T₃ levels, even in CKD patients with normal thyroid status, contribute to mortality in this patient population.

In this study it was observed that that majority patients had normal serum T₄ level in both groups, which was 49(96.1%) in group A and 46(92.0%) in group B. The mean serum T₄ level was found 104.65±34.9 nmol/L varied from 26 to 172.9 nmol/L in group A and 138.8±31.5 nmol/L varied from 62.73 to 176.3 nmol/L in group B. The mean serum T₄ level was significantly ($p < 0.05$) lower in CKD patients with compared to controls. Similar result found in Chonchol et al³. Avasthi et al¹¹ mentioned that the mean serum T₄ value was

significantly less in patients of CKD as compared to controls (serum T₄ in CKD 5.99±0.92 µg/dl, controls 8.55±0.97µg/dl, p<0.05;). Twelve (40.0%) of the CKD patients as compared to none in the control group had serum T₄ concentration below the normal range.

In this present series it was observed that high serum TSH level was found in 19.6% in group A and 4.0% in group B. The mean serum TSH level was found 4.23±4.6 mIU/L varied from 0.23–23.5 mIU/L in group A and 2.06±2.5 mIU/L varied from 0.29 – 17.8 mIU/L in group B. The mean serum TSH level was significantly (p<0.05) higher in CKD patients. Lo et al² have shown the median TSH level was significantly higher in the hypothyroid group (5.30 vs. 1.41 mIU/L, P <0.0001), and as expected, there was a much higher proportion of individuals with an elevated thyroid peroxidase antibody level in this group (54.6% vs. 9.9%, P<0.001). Among the 733 individuals with TSH>4.5 mIU/L who were not receiving thyroid hormone treatment, 89.0% had evidence of subclinical hypothyroidism. Chonchol et al³ have obtained that the mean values of serum TSH 2.30±2.79 mIU/L has varied from 0.001 to 47.6 mIU/L. Serum mean TSH level and T₄ is significantly increased in patients of CKD as compare to controls 4.73±2.60ug/ml, vs 2.69±.34ug/ml (p<0.05) reported by Avasthi et al¹¹. High TSH levels was found in 43.3% of CKD patients had of more than 5 µg/ml as compared to controls (6.67%). These findings are consistent with present study but their findings are much higher than present study. Previous studies done by Joseph et al¹⁷, Robertson et al¹⁸ in CKD by patients had TSH values above the normal range. The above authors confirm that the association between low thyroid hormones, inflammation and increased mortality in the CKD population. Malik⁸ study it was found that TSH levels didn't show significant alternations between the uremic patients and the control group and they were within the normal range. Similar finding focused that on thyroid function in end stage renal disease obtained by Paqualini et al¹⁴, Pagliacci et al¹⁵ and Hardy et al¹⁶. These findings are different from current study that may be due to geographical location, sample size, difference in enrollment of different stages of CKD, difference in CKD duration.

Conclusion

In conclusion the mean serum level of T₃ is significantly associated with the CKD patients. Again, the mean serum level of T₄ is also statistically significantly related with the CKD patients. Furthermore, the mean level of TSH is significantly

associated with chronic kidney disease. This is a small sample size study in a single centre. Therefore, a large scale study should be conducted.

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