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Investigation Study of Relationship between Thyroid Hormones and Kidney Disorders in Iraqi Kidney Failure Patients

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Annotation: Background: Early in the course of kidney failure, bone abnormalities and resorptions were noted. This led to studies that looked at thyroid hormones (tetra iodothyronine (T4), triiodothyronine (T3), and serum calcium (Ca+2) levels to determine the incidence and severity of skeletal problems in individuals with chronic renal failure (CRF).

Methods: A control group of 55 healthy individuals and 55 patients (40/40 male and female) with chronic kidney disease (mean glomerular filtration rate, or GFR) of < 15 ml/min were included in the study.

Results: When compared to the control group, the more severe stages of renal failure were associated with a highly significant decrease in thyroid hormones (T3, T4) and a highly significant increase (P˜ 0.001) in Ca+2 levels. Additionally, the findings indicated that T3 and T4 had high positive relationships (r = 0.801). Additionally, the data indicated a significant negative association (-0.911, -0.800) between T3 and Ca+2 and T4 and Ca+2.

Conclusion: there is a strong correlation between kidney diseases and the levels of serum Ca+2 and thyroid hormones (T3, T4).

Keywords: Chronic kidney failure, Thyroid hormones, Calcium.

Introduction

Patients with moderate chronic renal failure (CRF) hardly ever exhibit clinical signs. However, research conducted in the past year has shown that over 50% of patients with moderate renal failure only have abnormal bone histology[1,2], which suggests that skeletal changes may begin years before symptoms appear, or at least in some patients at very early stages of CRF[3]. There aren't many studies on people with moderate to mild CRF. Additionally, the majority of patient groups are small, and the severity and inferred renal disease terms on renal ailments4 have diverse conclusion criteria[4].

The results of serum tests for thyroid hormones (T3, T4) and ionized calcium (Ca^{+2}) were gathered in an effort to estimate CRF clinically and generally. Currently, when monitoring bone matrix in patients on CRF [5, 6], biochemical parameters of thyroid hormones, calcium, and all of bone turnover were found to be significant in metabolic kidney diseases.

The study's objective was to investigate the relationship between chronic renal failure and thyroid hormones (T3, T4) and calcium.

Methodology

Patients and control

Following a diagnosis by a urology unit, the population samples were taken from Al-Hussein Medical City in Karbala, Iraq, and transported to a dialysis unit between September 2024 and November 2024. Fifty-five patients with chronic renal failure, ages 20 to 50, were included in the sample.

The healthy group consisted of 55 participants whose ages matched those of the patients and who did not exhibit any symptoms or indicators of renal failure.

Collection of Specimens

Early in the morning, five milliliters of venous blood were extracted from both the control group and patients with renal failure. Following a 15-minute centrifugation at 3000 xg, the serum was extracted and deep-frozen at -70 ´C until analysis.

T3 and T4 Assessment

The COBAS c311 system and the human T3 and T4 kit were used to determine serum T3 and T4 levels.

Calcium Assessment

Calcium (Ca+2) was assessed by Using a spectrophotometer and a Spinreact (7) E-17176 Sant Estevede bas (GI), Spain kit, the concentration of Ca+2 in the serum was determined.

Statistics

The statistical program for social sciences (SPSS) version 27 was utilized to perform statistical analysis on our data. The findings were analyzed using the student t-test. Mean ± standard deviation (S.D.) was used to express all of the data. A P-value of less than 0.05 was deemed significant.

Results

The findings demonstrated that compared to the healthy group, individuals with chronic renal failure had significantly lower T3, T4 (P=0.001) and significantly higher Ca+2 (P=0.001) levels (Table 1).

Table 1: The levels of parameters under study to chronic renal failure patients and control group

Parameters	Patients n=55 Mean ± S.D	Control n=55 Mean ± S.D	P-value
T_3 (nmol/L)	2.81±1.44	3.10±1.28	0.001
T_4 (nmol/L)	62.14±22.80	101.43±28.0	0.001
Ca^{2+} (mg/dl)	30.95±11.90	1.88±1.22	0.001

The patients with chronic renal failure in this study were divided into two groups based on their gender. There were 40 male patients (50%) in group 1 and 40 female patients (50%) in group 2. While there were no significant variations in the concentrations of other parameters (P>0.05), the results indicated that female patients had a lower T3 level (P=001) than male patients (Table 2).

Table 2: The levels of parameters under study to patients on chronic renal failure according to genders

Parameter	Male n=40 Mean ± S.D	Female n=40 Mean ± S.D	P-value
T_3 (nmol/L)	1.76±1.17	1.39±1.27	0.001
T_4 (nmol/L)	59.60±22.19	67.30±18.97	0.070
Ca^{2+} (mg/dl)	28.30±9.56	30.20±10.22	0.130

The correlation between the markers in our investigation was calculated using Person's correlation coefficient. The findings indicated that T3 and T4 had a significant positive connection (r = 0.801). Additionally, the results showed that T3 and Ca+2 had a substantial negative association (-0.911 and -0.800, respectively) (Table 3).

Table 3: The correlations between parameters under study to chronic renal failure patients

Parameter1	Parameter2	n	(r)	P-value
T_3	Ca^{2+}	55	-0.911**	0.001
T_4	Ca^{2+}	55	-0.800**	0.001
T_4	T_3	55	0.801**	0.001

**Correlation is significant at the 0.01 level

Discussion

The idea of bone research is that, although the specific biochemical indicators of bone turnover were extensively studied in the previous decade, the results did not show that they could be used for a single patient's diagnosis. However, there may be some applications in the subsequent clinical attempts[7]. Significant intra-individual variability[8], and a strong correlation between parameters and the rate of bone loss[9], are the reasons for the limitations in everyday clinical applications.

Research on the use of biochemical bone markers in pre-dialysis CRF patients is limited, and it has been determined that renal clearance reduction is the source of bone resorption and osteocalcin[10,11].

At an early stage of renal failure, the findings of this study are linked to the results of histomorphometric tests, which begin with bony changes[12]. According to Malluche et al. (2013), pre-dialysis CRF patients had lower BMD levels, which correlate with a decline in GFR[13]. It is explained that complexity with bone cortex was equally impaired in those uremic patients, despite the fact that they disclosed that only the bone cortex was impacted, which contradicts the current findings. One possible explanation for this contradiction is that the scanning methods or patient categories differed.

Patients with low T3 levels varied significantly depending on how advanced their CRF was. Additionally, a positive correlation between GFR and serum T3 was discovered in both the male and female groups, as well as in every control group[14]. Reduced T3 syndrome was shown by Sang et al. (2009) to be quite common in CRF patients and to have observable effects in the early stages of the disease[15,16]. Additionally, Fan et al. (2016) reported that patients with pre-dialysis CRF were examined for a highly prevalent reduced T3 syndrome until the disease remained in its early stages (stages 1 and 2). Finding a predictor of the worst instances of CRF patients is indicated by the rising prevalence of low T3 levels in these patients[17].

In patients with CRF, both elevated and decreased Ca+2 levels can be harmful. While lower levels of Ca+2 may increase the risk of fractures or osteoporosis, higher levels may increase the risk of cardiovascular illnesses or vascular calcinations [18, 19]. Furthermore, Moscovici et al. (2010) showed that Ca+2 and PO4-3 abnormalities were not noticeable until the latter phases (stage 4) of CRF, which primarily affected patients in the early stages. Therefore, those mineral disorders were not the only cause of the increased cardiovascular disease risks in those CRF patients[20].

Dhanwal (2011) demonstrated that patients with chronic renal failure (CRF) may experience bone resorption in the future. In patients with untreated osteoporosis, serum vitamin D and calcium levels combined with thyroid hormone assay results (T3, T4) may offer useful markers of bone turnover or resorption as well as therapeutic monitoring[21].

Conclusion

Serum thyroid hormones (T3, T4) and serum Ca+2 levels are closely correlated with kidney diseases.

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