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EFFECT OF CHRONIC RENAL DIALYSIS ON THE LEVEL OF THYROID GLAND HORMONES AMONG PATIENTS WITH CHRONIC RENAL FAILURE

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ABSTRACT

The purpose of this study was to assess the effect of haemodialysis on thyroxin level in patients with chronic renal failure. The sample of this study included forty nine participants (28 male and 21 female). Eligible participants were patients on regular dialysis for more than 1 year at the time of enrollment, had no co morbidity, and had no known previous thyroid dysfunction. The study was conducted in one educational hospital in Jordan.

Serum level of thyroid hormones T4 and T3, were measured prior to the dialysis session and after completion.

There was a statistically significant increase in the level of T3 and T4 after completion of dialysis; however, this increase did not go beyond the normal value.

Haemodialysis initiate a trend for increase in the level of thyroxin hormones. Patients on chronic dialysis need vigilant assessment for thyroid function in order to prevent future complications.

Keywords: CRF, Haemodialysis: thyroid hormones: creatinine; urea

INTRODUCTION

Chronic renal failure (CRF) is defined as kidney impairment that can last for more than three months and is associated with decrease urine production and significant build up of waste products(Razmaria, 2016). Although chronic renal failure is a common complication for endocrine disorders (Kuczera, Adamczak, & Wiecek, 2015; Singh, Raed, & Kari, 2015) many of these disorders are asymptomatic which made diagnosis of these disturbances hard. Laboratory values have been the mainstay in the diagnosis of thyroid dysfunction (Mohamedali, Reddy Maddika, Vyas, Iyer, & Cheriyath, 2014; Parsa & Gharib, 2018)

Several conditions are associated with thyroid hormone deficiency such as hypopituitarism and impairment of synthesis within the thyroid gland itself. Thyroid activity is regulated by the pituitary gland which secrete the thyroid stimulating hormone (TSH) (Tziaferi & Dattani, 2018; Zhang et al., 2018). Hypothyroidism can be classified into three types; primary, secondary, and cellular (Gupta & Lee, 2011; Kostoglou-Athanassiou & Ntalles, 2010). Primary hypothyroidism is diagnosed when there is an abnormal elevation in the level of TSH coupled with a significant decrease in the level of thyroid hormone. Secondary hypothyroidism is caused by pituitary gland malfunction and is diagnosed when there is significant decrease in the level of thyroid stimulating hormone (TSH), triiodothyronine (T3), and thyroxine (T4.) Thyroid gland cellular dysfunction is the main pathology that causes cellular hypothyroidism and is usually associated with low basal metabolic rate. It is diagnosed when there is normal serum level of T3, T4 (Persani, 2012)

Studies reported significant increase in the risk of goiter and other thyroid related insufficiency among patients with end stage renal diseases in comparison with their counterparts of normal health status (Lei et al., 2016; Lo et al., 2017)

Haemodialysis serves to remove waste products and extra fluid from blood; however it has been postulated that long term dialysis therapy may affect thyroid functioning (Malik, Raza, & Arunselvan, 2015; So & Arakaki, 2014). Few studies have investigated the effect of dialysis on thyroid function among patients on long term dialysis and thus, this study was conducted to

assess the effect of dialysis on the level of thyroid hormones among dialysis patients.

MATERIAL AND METHODS:

Design

This study used a quasi-experimental design with one group pre-post test comparison.

Participants

Eligible participants where patients who had diagnostic symptoms of chronic renal failure, had no past health history of thyroid dysfunction, underwent dialysis for at least one year, and had no co-morbidity.

Sample

G power software (Erdfelder, Faul, & Buchner, 1996) was used to calculate the sample size for this study. Based on power of 0.9, level of significance at 0.05, and an estimated medium effect size d= 0.5 the required sample size to run two tailed paired sample t test was 44. This study collected a convenience sample of 49 participants to compensate for the expected drop out rate.

Setting

This study was conducted in the renal dialysis unit of one governmental hospital in the north of Jordan. The unit capacity was 25 beds. The unit performs 3 dialysis sessions a day. The hospital was selected based on the reasonably large capacity, the availability of dialysis unit, and the ethical permission to conduct the study. Patients in this unit usually undergo three dialysis sessions per week with four sessions per hour

Ethical permission

This study was granted ethical permission from the institutional review board at the principal investigator's university and the participating hospital.

Data collection

At the day of the study, participants were approached in the dialysis unit, explanation about the study was provided and written informed consent was obtained. A data collection form was made for this study that included items about age, sex, and duration of dialysis, family history and presence of co-morbidity. Venous blood sample was obtained. Two blood samples were obtained from every patient hematology and chemistry. A master code list with the participants names and codes was created. Data were entered and stored on the principal investigator with restricted access. All hardcopies materials related to the study were appropriately discarded.

Sample Collection

The blood sample was collected from patients in the morning immediately before and after hemodialysis. The haematolgy blood samples were collected using EDTA bottles tubes and used for determining the hematological parameters described below. The chemistry blood samples were allowed to settle for 30 min and then centrifuged using a bench top centrifuge to collect plasma/serum.

Hematological Analysis:

Complete blood count (CBC) was performed using the Automated hematology analyzer.

Biochemical Analysis

Urea and creatinine quantization was performed using commercial analytical kits from Sigma (Lab-Kit, Spain).

Thyroid Function Assay

Total T3 and T4 were determined by using the total Triiodothyronine T3 and the total thyroxin T4 immunoassay test kits (Biocheck, INC, USA). TSH concentration was measured using the Enzyme assay for the ultrasensitive Quantitative determination of TSH in human serum (Biocheck, INC, USA).

Statistical analyses

Means and standard deviations were calculated and two-sample t-test and Mann-Whitney U-test was used to compare the change of hormones before and after dialysis.

RESULTS

The studied sample included 28 males forming 57.1% of the sample of the participants only 8.2% of the samples were less than 20 years of age, while 28.6% were 21-40 years of age. The highest percentage of sample age ranged from 41-60 years with percentage 44.9%. Participants who were older than were 18.4% (Table 1).Bulk of sample (42.9%) has renal failure since less than 5 years, while 26.5% since 5-10 years, 16.3% since 11-15 years and 4.1% had renal failure for 16 years or more.

Our data showed statistically significant increase in the levels of T3 and T4 following dialysis; however the change in the level of TSH was not significant (Table1). In addition, female participants showed much better increase in T3 and T4 when compared with male (Table 2).

Table 1: The effect of dialysis on thyroid function (T4, T3, TSH, Urea, and Creatinine)

Test	Normal range	Treat.	Mean ± std. error	t-value	Sig.
T4 (ngdl)	0.71-1.85	Before	0.80 ± 0.032	3.337	0.001*
		After	0.97 ± 0.039		
TSH (UIUml)	0.47-5.00	Before	3.02 ± 0.165	0.882	0.380
		After	3.22 ± 0.152		
T3 (pgml)	1.45-3.48	Before	1.57 ± 0.068	4.732	0.001*
		After	2.02 ± 0.066		
UREA (mgdl)	15-49	Before	146.98 ± 5.65	13.99	0.001*
		After	53.12 ± 3.62		
CREATININE (mgdl)	0.7-1.30	Before	9.56 ± 0.393	11.529	0.001*

Table 2: gender differences inT4, T3, TSH, Urea, and Creatinine level after dialysis

Test	Normal range	Treat	Mean ± std. error	t-value	Sig.	No. of patients	%
T4 (ngdl)	0.71-1.85	Male	0.909 ± 0.036	1.854	0.070	25	89.3
		Female	1.051 ± 0.0748			19	90.5
TSH (UIUml)	0.47-5.00	Male	3.392 ± 0.205	1.315	0.195	27	96.4
		Female	2.990 ± 0.223			20	95.2
T3 (pgml)	1.45-3.48	Male	1.956 ± 0.095	1.145	0.258	23	82.1
		Female	2.107 ± 0.0847			21	100.0
UREA (mgdl)	15-49	Male	62.00 ± 5.37	3.070	0.004	8	28.6
		Female	41.29 ± 3.03			16	76.2
CREATININE (mgdl)	0.7-1.30	Male	4.52 ± 0.429	2.30	0.026	0	0.0
		Female	3.28 ± 0.244			0	0.0

DISCUSSION

Our findings were consistent with other studies that revealed significant effect for dialysis on the levels of T3, T4 (Iglesias & Diez, 2009) One study reported that dialysis stimulated a trend for hypothyroidism in patients with chronic renal failure (Connor & Taylor, 2008). One reasons for this finding were the reduction in the concentration of thyroxin binding globulin and the presence of thyroid hormone binding inhibitors (Pakhle et al., 2017).

Other studies in support to this study have shown that increase in serum levels of toxic compounds in dialysis patients. That entailed diminishing serum levels of thyroid hormones (SNN, 2013). Another reason is that iodide excretion is diminished in chronic renal failure, leading sequentially to an elevated plasma inorganic iodide concentration and an initial increment in thyroidal iodide uptake (Palmer & Henrich, 2011). Increases in total body inorganic iodide can potentially block thyroid hormone production.

CONCLUSION

Patients who undergo dialysis are at high risk for thyroid gland disturbances. Therefore, it is important that patients who show increased levels of T3 and T4 be carefully assessed and treated in order to prevent significant deterioration in thyroid gland function.

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