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Thyroid abnormalities among Egyptian Patients with End Stage Renal Disease on Regular Hemodialysis

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ABSTRACT

Background: Kidney impairment, even if just slightly, would affect the thyroid gland, creating numerous derangements in its function, and this renders dialysis cases more exposed to thyroid problems, with a consequent rise in death rate and morbidities.
Aim of the study: We aimed to investigate thyroid abnormalities among Egyptian cases with end stage renal diseases (ESRD) on regular haemodialysis (HD).
Patients and Methods: This was cross-sectional observation report, 160 subject were enrolled at Al-Hussein Hospital, Al-Azhar University and National Institute of Nephrology and Urology during the period from June 2021 to December 2021.
Results: There were significant correlation between FT3, TSH and Duration of dialysis, Urea After, Creat After, Hb.
Conclusion: Thyroid dysfunctions are widespread in ESRD cases, particularly those on steady HD, and the most common thyroid disease is subclinical hypothyroidism. Even with euthyroid dialysis patients, hypothyroidism symptoms are common. Owing to the overlay among ESRD signs and hypo-thyroidism, identification of hypothyroidism is challenging, and it is commonly ignored in the ESRD population. Early detection and treatment of hypothyroidism protects the patient's health from deteriorating and increases their chances of survival.

Keywords: *hemodialysis; thyroid disease; end-stage renal disease*

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INTRODUCTION

Thyroid dysfunctions are a frequent but under-familiar endocrine issue in dialysis ESRD cases [1]. Untreated hypothyroidism in the general population may have pervasive negative effects on several organ systems, including the kidney, because thyroid hormone receptors are found in practically all tissues [2]. Hypothyroidism and other thyroid functional test derangements have been linked to an increased risk of cardiovascular disease [3], poor outcome-related quality of life (HRQOL) [4], and death in non-dialysis depending (NDD) and dialysis-dependent CKD patients [5,6].

Endocrine abnormalities are a prevalent endocrine consequence in chronic renal disease patients, particularly those on dialysis [7].

Chronic kidney disease has a number of endocrine and metabolic consequences. One of the most frequent affects bone metabolism, resulting in CKD-MBD and secondary hyperparathyroidism. Hypothyroidism and nodular goitre are two other common endocrine diseases in cases with chronic renal diseases [8].

The percentage of patients with thyroid disease, particularly nodular thyroid goitre, could be assessed to aid in the right diagnosis and treatment of these patients [9].

The thyroid and kidney's interplay in each other's functioning has been known for many years. Thyroid hormones (TH) have a crucial role in kidney function. Their effects on kidney growth, development, and homeostasis are well-known and have been studied in the literature. Thyroid disorders, including hypothyroidism and hyperthyroidism, have a significant impact on renal function as well as cardiovascular changes [10].

Because of uremia that affect hpothalamo pituitary thyroid axis, hormonal clearance during dialysis,

lower T3-binding capacity, altered hormonal catabolism, disruption of iodine storage and binding in thyroid gland, serum thyroid auto-antibodies, and reduced peripheral conversions, peripheral thyroid hormones (T3 & T4) can have low serum quantities [11].

the Aim of this work was to investigate thyroid abnormalities among Egyptian cases with ESRD on regular HD.

PATIENTS AND METHODS

The current cross-sectional observational report was performed at Al- Hussein Hospital, Al-Azhar University and National Institute of Nephrology and Urology during the period from June 2021 to December 2021 on 160 patients with kidney disease. They will be divided into 2 groups as follows: Group A: 80 cases with chronic kidney diseases in different grades. Group B: 80 cases with ESRD of various primary causes on regular HD.

The study enrolled cases with 20-50 years old. The mean period of HD treatment 4± 3 years, clinically stable patients and patients signed a written informed consent.

While cases with preceding thyroid disease, previous thyroid operation, with (total or subtotal) and patients refused to participate or complete the study were excluded from the study.

Methods:

After signing written informed consents, all patients were subjected to the following procedures:

Demographic data were collected as age, sex, weight, duration of dialysis, medication and comorbidities as diabetes mellitus and hypertension. A comprehensive clinical and bio-chemical examinations was attained for all cases. All patients were clinically stable and free of active infections.

Laboratory tests: All patients had blood tests performed prior to the start of hemodialysis session and heparin administration, which will be incubated for at minimum 0.5 hour at 37°C on a water bath and centrifuged to deliver clear serum for CBC, kidneys, liver, and thyroid (T3, T4 and TSH) functions examinations.

Also, free tri-iodothyronine (FT3 reference range (RR) 3.4–6.8 pmol/L) and free thyroxin T4 (FT4 RR: 12-22 pmol/L—radio-immunoassay (RIA), thyroid-stimulation hormone (TSH) RR: 0.27–4.20 U/mL) were evaluated by chemiluminescence immunometric assay.

By means of a solo compartment dialysis urea kinetic model, the competence of HD has been determined as a fractionally clearance index for urea (Kt/V) and urea decrease ratio.

Hemodialysis: HD has been done 3 times weekly, 4 hrs per session on pump 300 ml per minute, Ultrafiltration according to weight, heparin administration 2500-5000 according to weight, the temperature of hemodialysis machine was 37°. Na 135, conductivity was 14 and type of machines Ver Senius 4008 B, S, S classic or Gampro AK 98.

Ethical consideration:

An approval was taken from Al Azhar University Hospitals and National Institute of Nephrology and Urology. And a permission was obtained by The Dialysis Center's Ethics Committee before conducting the study (IIT2/24.04.2019). After being briefed about the study's goals and procedures, all cases gave their knowledgeable agreement. The study techniques, as well as the service given, had no negative effects on the participants. Individual data has been safely retained as private information by the principal investigators. The volunteers did not have to pay anything extra, and the researchers covered all of the expenditures.

Statistical analysis:

collected data has been analyzed via the SPSS-23.0 (IBM, USA). The quantitative data has been introduced as mean±SD. Result was significant if P-value <0.05.

RESULTS

Demographics	CKD group (n=80)	ESRD on RHDX group (n=80)	Test value	p-value
Age (years)				
Mean±SD	43.08±4.84	41.81±9.65	t=1.052	0.294
Range	32-50	22-50		
Sex				
Female	50 (62.5%)	41 (51.3%)	x2=2.064	0.151
Male	30 (37.5%)	39 (48.8%)		

Table 1: Comparing among both groups as regard demographics. This table shows that an insignificant change was found among both groups regarding age or sex. *(*Using: t-Independent Sample t-test; x^2: Chi-square test; p-value >0.05 NS)

Duration of dialysis (years)	ESRD on RHDX group (n=80)
Mean±SD	3.65±1.97
Range	1-7.5

Table 2: Duration of dialysis (years) in ESRD on RHDX groupThe mean Duration of dialysis (years) in ESRD on RHDX group was 3.65(±1.97 SD).

Kidney function Urea Before	CKD group (n=80)	ESRD on RHDX group (n=80)	Test value	p-value
Mean±SD	95.53±22.27	106.78±13.61	t=-3.855	<0.001**
Range	50-153	75-150		
Creat Before				
Mean±SD	3.26±1.20	9.81±1.58	t=-29.571	<0.001**
Range	1.4-5.7	6.5-13		

Table 3: Comparison between both groups as regard kidney function. This table shows that there was high significant change among both groups as regard urea or create. (Using: t-Independent Sample t-test; **p-value <0.001 HS)

Hb.	CKD group (n=80)	ESRD on RHDX group (n=80)	Test value	p-value
Mean±SD	11.44±1.19	10.26±1.03	t=6.684	<0.001**
Range	9.2-13.7	8.3-13		

Table 4: Comparison between both groups as regard Hb. This table shows that there was significant change among both groups as regard Hb. (Using: t-Independent Sample t-test; **p-value <0.001 HS).

Liver function tests	CKD group (n=80)	ESRD on RHDX group (n=80)	Test value	p-value
SGOT				
Mean±SD	23.55±5.30	23.99±5.95	t=-0.491	0.624
Range	13-34	13-34		
SGpt				
Mean±SD	26.50±8.22	27.75±8.09	U=-0.969	0.334
Range	14-45	14-44		

Table 5: Comparison between both groups as regard liver function tests. This table shows that an insignificant change was found among both groups regarding Liver function tests.

Thyroid function	CKD group (n=80)	ESRD on RHDX group (n=80)	Test value	p-value
FT4				
Mean±SD	1.14±0.16	1.15±0.52	U=-0.090	0.929
Range	0.91-1.83	0.6-4.8		
FT3				
Mean±SD	3.07±0.52	2.33±0.50	U=9.175	<0.001**
Range	1.98-3.95	1.18-3.26		
TSH				
Mean±SD	2.56±0.80	2.26±0.94	U=2.136	0.034*
Range	1.02-4.88	0.44-4.28		

Table 6: Comparison between both groups as regard thyroid function. This table shows that a significant change was found among both groups regarding FT3 and TSH.

Kiendy function	ESRD on RHDX group (n=80)		Paired Sample t-test		
	Before	After	Mean diff.	t-test	p-value
Urea					
Mean±SD	106.78±13.61	63.03±8.34	43.75	43.830	<0.001**
Range	75-150	45-75			
Creat					
Mean±SD	9.81±1.58	4.03±0.45	5.78	38.425	<0.001**
Range	6.5-13	3.4-6			

Table 7: Comparison between before and after ESRD on RHDX group as regard kidney function. This table shows that there were high significant difference between before and after HDX in ESRD group as regard urea and create.

CKD group	FT4		FT3		TSH	
	r	p-value	r	p-value	r	p-value
Age (years)	-0.124	0.455	0.106	0.350	0.142	0.209
Urea	-0.183	0.280	0.140	0.214	0.287	0.140
Creat	-0.244	0.259	0.204	0.074	0.236	0.237
Hb.	0.145	0.706	-0.215	0.055	-0.160	0.790
SGOT	-0.120	0.554	0.163	0.148	0.048	0.673
SGpt	-0.118	0.617	0.100	0.378	0.064	0.572

Table 8: Correlation between thyroid function tests and different parameters in CKD group. There were insignificant correlation between FT4 and age, urea, creat, Hb, SGOT and SGPT.

ESRD on RHDX group	FT4		FT3		TSH	
	r	p-value	r	p-value	r	p-value
Age (years)	0.025	0.826	0.173	0.125	-0.164	0.147
Duration of dialysis (years)	-0.217	0.054	-0.618	<0.001**	0.089	0.433
Urea Before	-0.093	0.411	-0.102	0.368	-0.132	0.243
Urea After	0.007	0.954	-0.289	0.039*	-0.272	0.014*
Creat Before	-0.039	0.734	-0.012	0.919	0.048	0.673
Creat After	-0.075	0.507	-0.319	0.017*	-0.021	0.852
Hb.	0.182	0.107	0.418	0.004*	0.319	0.004*
SGOT	0.073	0.518	0.124	0.273	-0.040	0.722
SGpt	0.125	0.269	0.106	0.348	-0.102	0.368

Table 9: Correlation between thyroid function tests and different parameters in ESRD on RHDX group. There were significant correlation between FT3 and Duration of dialysis, Urea After, Creat After, Hb.There were significant correlation between TSH and Urea After and Hb.

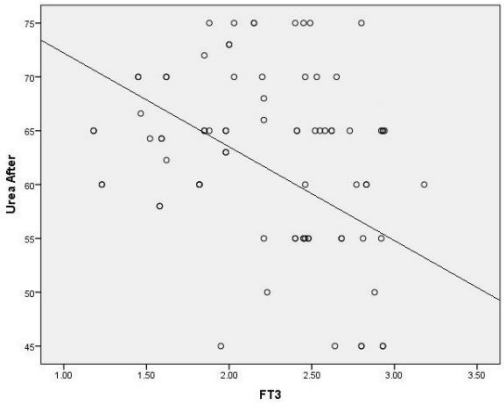

Fig 1: Correlation between FT3 and urea after.

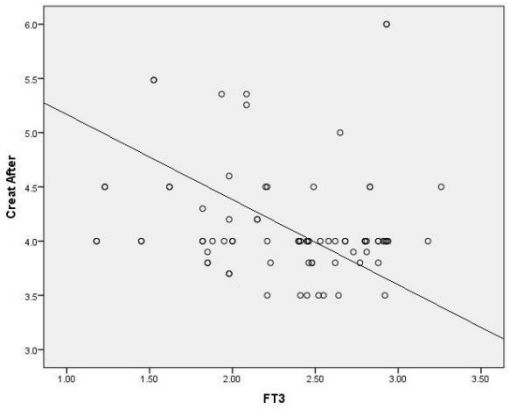

Fig 2: Correlation between FT3 and creat after.

DISCUSSION

The present study reported that there was insignificant difference between both groups as regard age or sex.

In line with the current work, a study by Ibrahim et al. [11], concerning thyroid functions (TSH, FT3 and FT4). The study was conducted on 40 maintenance regular hemodialysis patients (20 males, 20 females; mean age ± SD 50.33±9.24 years) and 20 age-matched healthy control subjects (10 males, 10 female; mean age ± SD 47.65±8.93 years). A nonsignificant change in age, gender or BMI between the maintenance hemodialysis patients and healthy control subjects.

My study demonstrated that there was high significant difference between both groups as regard urea before (mean 106.78±13.61) or creatinine before (mean 9.81±1.58) urea (mean 95.53 ±22.27) creatinine (mean 3.26 ±1.20) for CKD group.

As in CKD group kidney still functioning by different degrees according CKD grade and can remove urea, creatinine and other waste products.

This agrees with:

Bichari et al. [12] showed that mean 120.870 ± 5.057 and mean creatinine was 9.530 ± 2.692.

Cotoi et al. [6] showed that mean urea was 122.2 c 29.66 and mean creatinine was 8.9 ± 2.32.

My study illustrated that there were high significant difference between both groups as regard HB, CKD group (mean 11.44 ±1.19) for ESRD group (mean 10.26±1.03)

This is mostly due to Erythropoietin hormone deficiency also nutritional deficiency more prominent in ESRD

This agrees with Saha et al. [13] conducted a cross-sectional investigation in adult patients with CKD receiving HD at the Mexican Institute of Social Security in the northern part of Mexico City. The levels of haemoglobin (Hb) and hemocrit (Htc), as well as clinical and biochemical variables linked to anaemia, were assessed. A total of 747 individuals were studied, with an average haemoglobin of 9.7 g/dl. Hb 10.0 g/dl cutoffs were used to separate the group into two. Hemoglobin levels below 10.0 g/dl were seen in 56% of the patients. Hb levels of 10.0 g/dl were linked to diabetes mellitus, hyperphosphatemia, high calcium-phosphate product and iron deficiency. Glomerulopathies, female gender and erythropoietin administration were associated with hemoglobin ≥10 g/dl.

My study showed that there was insignificant difference between both groups as regard Liver function tests for CKD group SGOT (mean 23.55±5.30) SGPT (mean 26.50±8.22) for ESRD group SGOT (mean 23.99±5.95) SGPT (mean 27.75±8.09).

This is in contrast with Gatua et al. [(14)] conducted a case-control on a number of 180 cases with CKD and 200 healthy controls chosen among blood donors to act as the control group. A total of 2.0 mL of venous blood sample was taken from all cases and controls. AST, ALP, ALT, γ-Glutamyl Transferase (γ-GT), and LDH enzyme levels have been determined. Albumin and total protein levels were considerably low in the CKD group when compared to controls. AST and ALT levels were significantly low in CKD cases, but GGT, LDH, and ALP levels were significantly elevated in CKD cases in comparison to controls. Between control people and CKD patients, there were nonsignificant variations in direct and total bilirubin levels.

My study showed that a high significant change was found among both groups as regard FT3 (mean 3.07±0.52) for CKD and (mean 2.33±0.50) for ESRD group also significant difference between both groups as regard TSH (mean 2.56±0.80) for CKD and (mean 2.26±0.94) for ESRD group.

This is explained by disruption of thyroid function in different ways including decrease thyroid hormones in circulation, decrease protein binding and upset storage of iodine in thyroid gland also disturbance of hypothalamo pituitary thyroid axis [15].

Also in uremia there is decrease in conversion of T4 into T3, disturbed binding of T4 to thyroid binding globulin by heparin and free fatty acids in the blood, this is more prominent in ESRD group also HDX and malnutrition in ESRD euthyroid patients affect thyroid hormones concentration in circulation [16].

This agrees with the results by Ozen et al. [17], who assessed the prognostic value of s-FT3 levels on survival in HD, low T3 was reported in 72% of the patients.

These data are similar to what was found by Rhee et al. [18] who found that among the studied HD patients, 87.1% were in the euthyroid state.

Also, in the study of Chonchol et al. [19] 9.5 % of the studied patients had subclinical hypothyroidism.

In contrast with the present study, a study by Kutlay et al. [20] reported hyperthyroidism in 1.14% in ESRD patients under HD.

Bichari et al. [(12)] showed that as regards TSH, 92% of the patients had abnormal TSH and 8% had normal TSH, as for free T3; 67% of the patients were normal and 33% were abnormal, and as for free T4; 89% of the patients were normal and 11% were abnormal.

In my study for CKD group, there were insignificant correlation between FT4 and age, urea, creat, Hb, SGOT and SGPT.

For ESRD on RHDX group, there were insignificant correlation between FT4 and age, urea before HDX, creatinine before HDX, Hb, SGOT and SGPT

Bichari et al. [12] showed that there was no relationship between etiology of chronic renal failure and thyroid function tests. A nonsignificant relationship among thyroid functions and the virological state of the cases.

In the current study a highly significant correlation was found between FT3 and duration of HDX (mean 3.65±1.97), urea after , creatinine after also there was significant correlation between TSH and duration of HDX(mean 3.65±1.97), urea after (Inverse relationship) while positive correlation between FT3, TSH and HB.

This agrees with Bichari et al [12] showed that regarding the correlations between thyroid hormones and the various clinical and laboratory data, they found only a significantly direct association between TSH levels and duration of hemodialysis.

This is in accordance with Sanai et al. [21] who found successive decrement of TSH with increasing dialysis duration.

CONCLUSION

Thyroid dysfunctions are an ordinary result in ESRD cases, specifically those on systematic HD, according to the findings of this study, and sub-clinical hypo-thyroidism is the commonest thyroid condition. Even with euthyroid dialysis patients, hypothyroid symptoms are prevalent. Owing to the overlapping

among ESRD signs and hypo-thyroidism, identification of hypothyroidism is challenging, and it is commonly ignored in the ESRD population. Early detection and treatment of hypothyroidism protects the patient's health from deteriorating and increases their chances of survival.

Conflict of interest : none

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