Original Article

Prevalence of hypothyroidism among chronic kidney disease patients in security force hospital (SFH) in Saudi Arabia

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Abstract

Introduction: Impairment in kidney function leads to disturbed thyroid physiology. All levels of the hypothalamic-pituitary-thyroid axis may be involved, including alterations in hormone production, distribution, and excretion, and even CKD progress with hypothyroidism. **Aim of Work:** To assess the prevalence of hypothyroidism among chronic kidney disease patients. **Materials and Methods:** A cross-sectional analysis was conducted in the nephrology department of security forces hospital from January 2015 to February 2018. Biochemical tests (includes blood urea, serum creatinine, PTH, total T4, TSH) were carried out to all participants. **Results:** Out of 255 CKD patients in the present study, 166 patients had no hypothyroidism, 43 had subclinical hypothyroidism, and 46 had hypothyroidism. The percentage of hypothyroidism among CKD patients was 34.9%, including dialysis patients and 17.66% after exclusion. Out of 24 peritoneal dialysis patients in the current study ($P = 0.03$), 7 had subclinical hypothyroidism and another 7 had hypothyroidism. In addition, out of 139 hemodialysis patients ($P = 0.02$), 20 patients had subclinical hypothyroidism and 18 had hypothyroidism. The majority (67.36%) of CKD patients were in CKD stage 5 and had no hypothyroidism (45.10%). Only 29 (11.37%) patients in CKD stage 5 had hypothyroidism and 28 (10.89%) patients had subclinical hypothyroidism. T4 was higher in nondialysis patients, whereas TSH and PTH were higher in dialysis patients. **Conclusion:** The prevalence of hypothyroidism among chronic kidney disease patients was high and increased with the decrease in estimated GFR.

Keywords: Chronic kidney disease, hypothyroidism, subclinical hypothyroidism

Introduction

Many data suggest a relationship between chronic kidney disease and hypothyroidism, most of them subclinical hypothyroidism.[1-4] It has been shown in studies that hypothyroidism had a cardiovascular risk and it can increase the mortality in a dialysis patient.[5-8]

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Some studies indicate that treating hypothyroidism can preserve kidney function in chronic kidney disease.[9,10] Establishing hypothyroidism diagnosis among chronic kidney disease patients is difficult and depends purely on biochemical parameters. Therefore, reviewing the relationship between hypothyroidism and chronic kidney disease is essential. This challenging question had been tested, and the researchers faced some difficulties like high urea can move the thyroid hormone from its binding protein,[10] use of heparin can increase free thyroxine,[11,12] and peritoneal dialysis can remove the thyroxine.[13]

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However, there is no Saudi data regarding the prevalence of hypothyroidism in patients with chronic kidney disease. Therefore, we conducted this survey to establish a database for subsequent studies.

Materials and Methods

We performed a cross-sectional analysis based on the database of the laboratory information system of the clinical chemistry laboratory at security forces hospital to retrieve results of serum creatinine, thyroid-stimulating hormone TSH, free T4, and parathyroid hormone PTH, which have been performed. Outpatient adults (over 18 years of age) followed in nephrology department from January 2015 to February 2018.

Serum TSH and free T4 concentration were quantified.[14] The value of TSH is 0.27–4.20 mIU/L and free T4 is 12–20 pmol/L, which were calculated from the estimated GFR.[15]

Serum TSH and free T4 concentration were quantified by electrochemiluminescence immunoassay "ECLIA" using cobas e 411 analyzer (Roche). The reference value of TSH is 0.27–4.20 mIU/L and free T4 is 12–20 pmol/L. The stages of CKD were referenced from kidney disease improving global outcome (KDIGO) guidelines. We defined hypothyroidism as TSH level >5.5 mIU/L and an FT4 level <12 pmol/L. Subclinical hypothyroidism was defined as a TSH level >5.5 mIU/L and normal level of FT4.

Exclusion criteria were subjects younger than 18 years, pregnant women, and subjects receiving antithyroid drugs presumably for hyperthyroidism. In the case of the blood tests not done together, we relied on the closest one.

Results

Table 1 shows that, out of 255 CKD patients in the present study, 166 patients had no hypothyroidism, 43 had subclinical hypothyroidism, and 46 had hypothyroidism. The percentage of hypothyroidism among CKD patients was 34.9%. Out of 24 peritoneal dialyses (PDs) patients in the current study ($P = 0.03$), 7 had subclinical hypothyroidism and another 7 had hypothyroidism. In addition, out of 139 hemodialysis (HD) patients ($P = 0.02$), 20 patients had subclinical hypothyroidism and 18 had hypothyroidism.

Table 2 shows the mean age of the CKD patients was 64.26 years in nonhypothyroidism, 62.88 years in subclinical hypothyroidism, and 63.13 years in hypothyroidism. The mean creatinine of the CKD patients was 385.40 in nonhypothyroidism, 364.02 in subclinical hypothyroidism, and 383.60 in hypothyroidism. Regarding the normal range 12–20 pmol/L of free T4, the mean T4 of the CKD patients was 15.04 in subclinical hypothyroidism and 12.96 in hypothyroidism, whereas 14.83 in nonhypothyroidism. The normal range of TSH is 0.27–4.20 mIU/L, the mean TSH of the CKD patients was 5.7 in subclinical hypothyroidism and 7.6 in hypothyroidism,

Table 1: Comparison of different variables in nonhypothyroidism, subclinical hypothyroidism, and hypothyroidism

Factors	CKD=255			*P*
	No	Subclinical	Yes	
Gender				0.25
Male	108	28	24	
Female	59	14	22	
DM				
No	47	12	19	0.21
Yes	120	30	27	
HTN				
No	15	5	6	0.67
Yes	152	37	40	
IHD				
No	129	33	34	0.76
Yes	38	8	12	
Transplant				
No	145	38	39	0.72
Yes	22	4	7	
PD				
No	157	35	39	**0.03**
Yes	10	7	7	
HD				**0.02**
No	66	22	27	
Yes	101	20	18	
TOTALS	166	43	46	

Table 2: Mean of different analysis in nonhypothyroidism, subclinical hypothyroidism, and hypothyroidism

Factors	Hypothyroidism		
	No	Subclinical	Yes
Mean Age	64.26	62.88	63.13
Mean Creatinine	385.40	364.02	383.60
Mean T4	14.38	15.04	12.96
Mean TSH	2.04	5.7	7.6
Mean eGFR	27.65	24.62	31.39

whereas 2.04 in nonhypothyroidism. Finally, the mean Estimated Glomerular Filtration Rate eGFR of the CKD patients was 27.65 in nonhypothyroidism, 24.62 in subclinical hypothyroidism, and 31.39 in hypothyroidism.

Table 3 shows that the majority (67.36%) of CKD patients in the present study were in CKD stage 5, and 45.10% had no hypothyroidism. Only 29 (11.37%) patients in CKD stage 5 had hypothyroidism and 28 (10.89%) patients had subclinical hypothyroidism. Table 4 shows the frequency of CKD patients after the exclusion of dialysis patients, mainly from CKD stage 5. The prevalence of hypothyroidism among CKD patients was 34.9%, including dialysis patients and 17.66% after exclusion.

Figure 1 shows the PTH percentage in CKD patients in the three groups of the present study. PTH was higher in the non hypothyroidism in the no hypothyroidism CKD patients than

Table 3: CKD stages in nonhypothyroidism, subclinical hypothyroidism, and hypothyroidism

CKD stage	Hypothyroidism		
	No	Subclinical	Yes
	Frequency (overall %)	Frequency (overall %)	Frequency (overall %)
1	5 (1.96%)	1 (0.39%)	1 (0.39%)
2	13 (5.10%)	1 (0.39%)	8 (3.14%)
3	24 (9.41%)	5 (1.96%)	5 (1.96%)
4	10 (3.92%)	7 (2.75%)	3 (1.18%)
5	115 (45.10%)	28 (10.98%)	29 (11.37%)

Table 4: CKD stages in nonhypothyroidism, subclinical hypothyroidism, and hypothyroidism after dialysis patient's exclusion

CKD stage	Hypothyroidism		
	No	Subclinical	Yes
	Frequency (overall %)	Frequency (overall %)	Frequency (overall %)
1	5 (1.96%)	1 (0.39%)	1 (0.39%)
2	13 (5.10%)	1 (0.39%)	8 (3.14%)
3	24 (9.41%)	5 (1.96%)	5 (1.96%)
4	10 (3.92%)	7 (2.75%)	2 (2.2%)
5	4 (4.4%)	1 (1.1%)	4 (4.4%)

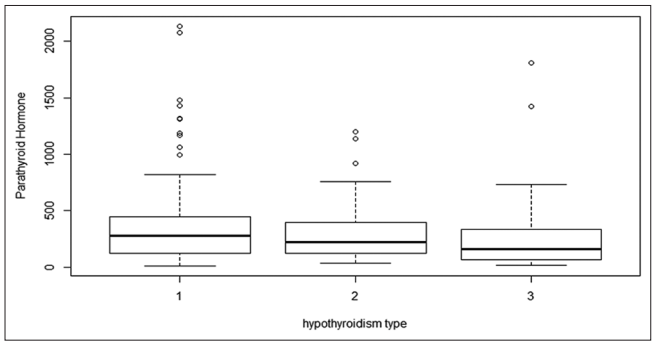

Figure 1: Average PTH between three Hypo groups 1 = no, 2 = subclinical, and 3 = Yes data: $F = 0.87543$, num df = 2.00, denom df = 83.98, P-value = 0.4205

the hypothyroidism CKD patients. However, PTH was higher in hypothyroidism patients than subclinical hypothyroidism patients.

About 6 patients had missing PTH value in the PH and HD groups, and about 4 patients had no PHD value in the HD group.

Table 5 shows that there were 163 dialysis patients in the current study: 139 HD and 24 PD, whereas 91 CKD patients had no dialysis. T4 was higher in nondialysis patients compared to PD and HD patients (14.87 vs. 13.98 vs. 13.85), respectively. TSH was higher in the dialysis patients, both HD and PD patients compared to nondialysis (9.128 and 6.548 vs. 3.877). PTH was higher also in the dialysis patients, specifically in PD (610.62) than HD patients (374.744) compared to nondialysis patients (184.898). The mean eGFR was higher in nondialysis patients compared to PD and HD patients (48.16 vs. 15.34 vs. 16.73), respectively.

Discussion

In the present study, out of 255 CKD patients, 166 patients had no hypothyroidism, 43 had subclinical hypothyroidism, and 46 had hypothyroidism. The percentage of hypothyroidism among CKD patients was 34.9%, including dialysis patients and 17.66% after exclusion. The interactions between kidney and thyroid functions are known for years.[16-19] Thyroid hormones are essential for the growth and development of the kidney and the maintenance of water and electrolyte homeostasis. From the other point of view, the kidney is involved in the metabolism and elimination of TH. Both hypothyroidism and hyperthyroidism are associated with remarkable alterations in the metabolism of water and electrolyte, as well as in cardiovascular function.[20,21] All these effects result in changes in water and electrolyte kidney management. Furthermore, the decline of kidney function is accompanied by changes in the synthesis, secretion, metabolism, and elimination of TH. Thyroid dysfunction acquires unique characteristics in those patients with advanced kidney disease.[22] In the current study, the mean GFR was higher in hypothyroidism (31.39) than in nonhypothyroidism (27.65) or subclinical hypothyroidism (24.62). In addition, GFR was higher in nondialysis patients.

Chonchol *et al.* found that primary subclinical hypothyroidism is a relatively common condition among persons with CKD not requiring chronic dialysis, and it is independently associated with progressively lower estimated GFR in a large cohort of unselected outpatient adults.[22]

Primary subclinical hypothyroidism is highly prevalent in the general population, especially in the elderly. Anyway, the prevalence of primary subclinical hypothyroidism in persons with CKD not requiring chronic dialysis is not well defined.[21]

In agreement with our results, Allawi performed a cross-sectional study on 50 patients with CKD, he found that reduced GFR was associated with an increased prevalence of hypothyroidism, with many subclinical cases.[23]

In on big cohort study, the prevalence of hypothyroidism in CKD patients whose eGFR below 60 around was 22%.[2] The incidence of hypothyroidism increase with a decrease in GFR in our study but was not statistically significant, unlike another study that showed significant results.[4,24] We considered the low number of our sample and loss of follow-up and the fact that most of our patients are in CKD stages 4 and 5 and they progress to dialysis need when they are referred to our tertiary hospital. Hence, we consider these factors as a key in changing the association between the fall in GFR and increase prevalence of hypothyroidism when we compare to other studies.

In the current study, PTH was higher in the nonhypothyroid CKD patients and in dialysis patients. However, T4 was higher in

Table 5: Comparing groups with HD=1 or PD=1 or (HD and PD=0)

Group	# of patients in the group	Mean t4
Regarding T4:		
No PD or HD	**91**	14.8762637
PD	**24**	13.9870833
HD	**139**	13.8537410
Group	**# of patients in the group**	**Mean TSH**
Regarding TSH:		
No PD or HD	**91**	3.8776923
PD	**24**	6.5483333
HD	**139**	9.1282734
Group	**# of patients in the group**	**Mean PTH**
Regarding PTH		
No PD or HD	85	184.8989412
PD	**24**	610.6208333
HD	135	374.7440000
Group	**# of patients in the group**	**Mean eGFR**
Regarding eGFR		
No PD or HD	**91**	48.1673114
PD	**24**	15.3486903
HD	**139**	16.7356149

nondialysis patients, whereas TSH was higher in dialysis patients.

The thyroid profile changes due to dialysis independent of that due to chronic renal failure. Dialysis also changes the previous serum status of TH in patients with renal failure. In Kannan *et al*. study, not all the patients with chronic renal failure have low T3 and T4. It is estimated that only 58% (29 patients) of patients have thyroid profile abnormality.[16]

Conclusion

The prevalence of hypothyroidism among chronic kidney disease patients was high and increased with the decrease in estimated GFR. Therefore, it is necessary to screen routinely for hypothyroidism in all chronic kidney disease patients.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There is no conflicts of interest.

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