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Evaluation of Hypothyroidism in Patients with Chronic Kidney Disease in Western Iran

Alireza Eskandarifar[1]*, Anvar Mohammadi Baneh[2], Hamide Alizadeh[3]

1. *Dept. of Pediatric, Faculty of Medicine, Kurdistan University of Medical Sciences, Sanandaj, Iran*
2. *Dept. of Nephrology, Faculty of Medicine, Kurdistan University of Medical Sciences, Sanandaj, Iran*
3. *Faculty of Medicine, Kurdistan University of Medical Sciences, Sanandaj, Iran*

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Corresponding Information:
Alireza Eskandarifar,
Dept. of Pediatric, Faculty of Medicine, Kurdistan University of Medical Sciences, Sanandaj, Iran
E-Mail: are1345@yahoo.com

ABSTRACT

Background & Objective: Chronic kidney disease (CKD) determined by permanent kidney damage. Due to the similarity of clinical symptoms of hypothyroidism with CKD, hypothyroidism may be neglected and remain untreated. The goal of our study was to evaluate the rate of hypothyroidism in CKD patients who need hemodialysis.

Materials & Methods: This is a cross-sectional research. The sampling method was census and included all CKD patients in need of hemodialysis, who had undergone hemodialysis for at least three months. Serum levels of thyroid stimulating hormone (TSH), thyroxine (T4) and triiodothyronine (T_3) hormones were measured in these patients, then the collected data were statistically analyzed.

Results: We studied 108 patients, 58 males (53.7%) and 50 females (46.3%). The mean age of the patients was 61.09 ± 13.45 years. The mean serum levels of hormones were as follows: TSH: 1.64±1.78 µIL/ml, T3:0.88 ± 0.2ng/dl, and T4:7.7±1.6 µg/dl.

In this study, 7.4% of the patients had high TSH levels, 3.7% of the patients had decreased T4 levels and 10.2% of the patients had lower than normal T3 levels.

Conclusion: The rate of hypothyroidism in CKD patients who needed hemodialysis was higher than the normal population. It is recommended that serum TSH, and T4 levels in CKD patients be measured regularly to detect subclinical hypothyroid cases.

Keywords: Chronic kidney disease, Hypothyroidism, Hemodialysis, Western Iran

Introduction

Chronic kidney disease (CKD) are determined by permanent kidney damage and progressive loss of kidney function. The stages of CKD are classified based on glomerular filtration rate (GFR). Stage 5 is called the end stage renal disease (ESRD), in which the patient´s life becomes dependent on renal replacement therapy (dialysis or transplant). The onset of CKD can be asymptomatic, or with symptoms gradually appearing with decreasing glomerular filtration rate (GFR). The symptoms of CKD include anorexia, nausea, vomiting, weight loss, fatigue, drowsiness, irritability, seizures, encephalopathy, and coma. Water - electrolyte imbalance, metabolic acidosis, hypertension, anemia, hyperphosphatemia and bone disorders, and uremic syndrome are other associated disorders **(1-3)**.

The thyroid gland is one of the important endocrine glands has a profound effect on increasing the body metabolism by secreting the two main hormones thyroxine (T4) and triiodothyronine (T3). The anterior pituitary gland regulates thyroid function by secreting Thyroid Stimulating Hormone (TSH). Hypothyroidism refers to cases in which the function of the thyroid gland is reduced. Symptoms of hypothyroidism include fatigue and weakness, impaired concentration and memory loss, constipation, weight gain, decreased appetite, decreased libido, and dry rough skin. Assessment of serum thyroid stimulating hormone (TSH) levels is essential for the diagnosis of primary hypothyroidism. In fact, normal serum TSH levels rule out primary hypothyroidism. Measurement of serum thyroxine (T4) levels is necessary to confirm the presence of clinical hypothyroidism if serum TSH levels are elevated. If the T4 levels were normal, the disorder would be called subclinical hypothyroidism **(4,5)**.

In patients with kidney disease, thyroid dysfunction occurs as a result of impaired blood flow, impaired metabolism of proximal hormones and carrier proteins. In addition, CKD affects the hypothalamic-pituitary-thyroid axis. The combination of the above factors can increase the risk of primary and subclinical hypothyroidism. **(6,7)**

The clinical signs and symptoms of hypothyroidism overlap with CKD. These two diseases cannot be differentiated only on the basis of clinical symptoms, therefore, the diagnosis of hypothyroidism may be delayed **(7-9)**.

Due to the great importance of the thyroid gland in the metabolism of human body and its role in increasing cardiovascular disease and quality of life, the goal of our study was to evaluate the rate of hypothyroidism in patients with CKD who need hemodialysis, emphasizing that paying more attention to the early diagnosis of hypothyroidism in CKD can help to improve the quality of life and reduce the rate of disability in patients. This article is the result of a research study on the prevalence of hypothyroidism in chronic kidney disease conducted for the first time in our region that can help to increase the epidemiological information on the disease and be a basis for increasing knowledge in the diagnosis and treatment of these disorders.

Materials and Methods

This cross-sectional study was carried out on the adult CKD patients requiring hemodialysis in Sanandaj, Kurdistan Province, west part of Iran in 2018. The study was performed after the approval of the ethics committee of Kurdistan University of Medical Sciences (IR.MUK.REC.1395/11). Informed consent was obtained from all patients before participating in the study.

The sampling method was census and included all patients with end-stage renal disease in need of hemodialysis, with at least 3 months of hemodialysis experience. These individuals underwent hemodialysis on an average of 3 times a week by a hemodialysis machine (Ferzinus, Gambaro).

The patients who had an underlying disease that could have led to errors in the results, such as history of thyroid disorders, consumption of drugs that affect thyroid hormones, autoimmune disease, diabetes mellitus, dyslipidemias and hypertension were excluded from the study.

We used venous blood samples of routine pre-dialysis tests for hormonal evaluation to reduce invasive interventions. Five ml of heparinized blood was transferred to the laboratory and serum levels of TSH, T4 and T3 hormones were measured by ELISA. Normal values of T4, T3, TSH were defined based on age and values mentioned for adults.

Demographic and biochemical information including place of residence, age, sex, weight, serum levels of TSH, T4, triiodothyronine (T_3), fasting blood sugar, triglyceride, cholesterol and blood pressure was recorded in a designed questionnaire after obtaining informed consent and maintaining confidentiality.

The collected data were entered into SPSS software version 21. Then, the frequency and percentage of the data were described by using mean and standard deviation.

Also, Fisher Exact test and independent t test were used for comparing qualitative and quantitative variables between normal and abnormal TSH, T4 serum levels.

Results

According to the inclusion and exclusion criteria, a total of 108 patients were included in the study, 58 (53.7%) male and 50 (46.3%) female. 97 people (89.8%) were urban and 11 (10.2%) were rural residents. The mean age of the patients was 61.09 ± 13.45years. 26 people (24.08%) were under 50 years and 82 (75.92%) were over 50 years.104 particip (96.3%) were married and 4 (3.7%) were single. In our study, the etiology of CKD based on the information contained in the patients' records was as follows: 52 patients (48.14%) with hypertension, 14 patients (12.96%) with diabetes, 4 patients (3.7%) with glomerulonephritis, 7 patients (6.48%) with polycystic kidney disease, 7 patients (6.48%) with urological problems, 10 patients (9.25%) with both diabetes and hypertension and 14 patients (12.96%) unspecified (table1).

The normal values of T4, T3, TSH based on the values mentioned in the kit used for adults are as follows:

TSH: 0.4 – 4.5 µIU/mL T3: 0.7-1.9 ng/dL T4: 5-µg/dl

In our study, the mean values of patients' hormone levels were as follows:

TSH: 1.64±1.78 µIU/mL T3:0.88 ± 0.2ng/dl T4:7.7±1.6 µg/dl

Serum TSH levels in 8 patients (7.4%) were higher than normal; serumT4 levels in 4 patients (3.7%) were lower than normal; and serum T3 levels in 11 patients (10.2%) were lower than normal. In our study, hypothyroidism was diagnosed as TSH> 4.5 µIU/mL with T4 <5 µg /dl, and subclinical hypothyroidism was diagnosed as high TSH and normal T4. Thus, 8 patients (7.4%) had thyroid dysfunction, of whom 4 patients (3.7%) had hypothyroidism and 4 patients (3.7%) had subclinical hypothyroidism (table1).

Table1. Characteristics of the study participants

Variables	Frequency	Percentage
Sex		
Men	58	53.7

Variables	Frequency	Percentage
Women	50	46.3
Residency		
Urban	97	89.8
Rural	11	10.2
Age Groups		
< 50 years	26	24
>50 years	82	76
Marriage Status		
Married	104	96.3
Single	4	3.7
TSH		
Normal	100	92.6
High	8	7.4
T4		
Normal	104	96.3
low	4	3.7
T3		
Normal	97	89.8
Low	11	10.2
Underling Diseases		
Hypertension	52	48.1
Diabetes	14	13
Glomerulonephritis	4	3.7
Polycystic kidney disease	7	6.5
Urological problems	7	6.5
Diabetes and Hypertension	10	9.2
Unspecified	14	13

Among those with high serum TSH levels, 7 people (8.5%) were over 50years and one (3.8%) was under 50 years (P:0.67). 4 patients (50%) were male and 4 (50%) were female. All of 8 (100%) abnormal TSH serum levels belonged to urban residents. The mean weight of patients was calculated based on body mass index, which was 26.2 ± 2.3 kg / m² in patients with thyroid disorder and 24.3 ± 3.4 kg / m² (P:0.12) in other patients . In patients with thyroid disorder, the mean systolic blood pressure was 145±25 mm Hg and diastolic blood pressure was 80±10 mm Hg; in other patients mean systolic and diastolic blood pressures were 135 ±15 mm Hg and 85±5 mm Hg, respectively (P<0.09).In this study, although people with severe disorder in fasting blood sugar and lipid profile were excluded, people with hypothyroidism had significantly higher blood sugar and lipid levels (P<0.01) (table2).

Table 2. Comparison of the study variables between the two groups of normal and abnormal TSH serum levels

Variables	TSH		P-value
	Normal	Abnormal	
Sex			
Men	54 (90%)	4 (10%)	1†

Variables	TSH		P-value
	Normal	Abnormal	
Women	46 (92%)	4 (8%)	
Residency			
Urban	89 (91.7%)	8 (8.3%)	1†
Rural	11 (100%)	0	
Age Groups			
< 50 years	25 (96.2%)	1 (3.8%)	0.67†
>50 years	75 (91.5%)	7 (8.5%)	
BMI (kg/m2)	24.3±3.4	26.2±2.3	0.12††
Systolic Blood Pressure (mmHg)	135 ±15	145±25	<0.09††
Diastolic Blood Pressure(mmHg)	85±5	80±10	<0.01††
Total Cholesterol(mg/dl)	170±21	210±35	<0.01††
Triglycerides (mg/dl)	112± 36	134±32	<0.01††
Fasting blood sugar(mg/dl)	95±14	105±10	<0.01††

†Fisher Exact test
†† Independent t test

Discussion

It is estimated that the average rates of clinical hypothyroidism and subclinical hypothyroidism in the normal population are about 0.3% and 4.3% respectively These rates may vary from about 1% in the East Asia to about 4.6 percent in the United States. Recent studies have reported a higher rate of thyroid dysfunction in people with kidney failure treated with dialysis **(8-14)**. In our study, 7.4% of the patients had high TSH levels and thyroid dysfunction, 3.7% of patients had decreased T4 levels and clinical hypothyroidism, and 3.7% of the patients had subclinical hypothyroidism; these rates of hypothyroidism were higher than the normal population**(1)** but lower than those reported in the Chandra's study(2016) in India**(11)**.

There are interactions between thyroid and kidney functions. Hypothyroidism affects the final function of the kidney by affecting renal blood flow and reducing GFR, as well as impairing renal tubular function. On the other hand, renal failure affects thyroid function by several mechanisms. These include decreased levels of circulating thyroid hormones, altered peripheral hormone metabolism, decreased carrier proteins binding, decreased tissue hormonal content, and increased iodine storage in the thyroid. In addition, CKD affects the hypothalamic-pituitary-thyroid axis. The above set of factors can lead to primary and subclinical hypothyroidism. It is suggested that the decrease in thyroid gland activity occur following the accumulation of waste products in patients, because the levels of these hormones increase after hemodialysis compared to previous levels **(10,15-18)**. The results of our study were consistent with various studies showing that thyroid hormone levels were lower in hemodialysis patients than in healthy individuals.

According to the findings of some studies in CKD patients, plasma T3 levels are often reduced, which can be due to a defect in the peripheral conversion of T4 to T3 as a result of uremia **(19-21)**. In the study by Jusufovic, serum T3 and T4 levels were lower than normal and TSH was higher than normal in dialysis patients and low T3 syndrome was reported in 12.5% of the patients **(22)**. In our study, the mean serum level of T3 was 0.88± 0.21 ng/dL, which was lower than normal in 10.2% of the patients. This result is consistent with previous studies.

In a study by Chonchol, 3,080 outpatients were studied and the prevalence of subclinical hypothyroidism was indicated 9.5%, which increased with decreasing GFR and the rate of subclinical hypothyroidism increased with age but was not related to gender **(8)**. In our study, the rate of hypothyroidism was equal in both sexes (4 men and 4 women) and its prevalence was higher in people over 50 years ($P<0.05$).

Hypothyroidism causes an increase in inflammatory markers in the vascular intima and ultimately exacerbates atherosclerosis and disorders of the systole and diastole of the heart leading to increased mortality from cardiovascular disease. Various studies have shown that there is an association between the rate of subclinical hypothyroidism in CKD patients and the risk factors for cardiovascular disease **(21, 23-25)**. In

our study, patients with hypothyroidism also had higher BMIs, higher blood pressure, higher blood sugar and lipid levels which could increase the risk of cardiovascular disease.

Study Limitations

One of the problems of our study was the small sample size. Obviously, if a study is conducted with a larger sample size, more accurate results will be obtained. We recommend that future studies compare the levels of hormones at the start of dialysis and 3 months later.

Conclusion

Based on our study, the rate of clinical and subclinical hypothyroidism in CKD patients who need hemodialysis is higher than the normal population. Since hypothyroidism can affect the quality of life of CKD patients and increase their cardiovascular complications and mortality and morbidity, it is recommended that serum T4 and TSH levels be measured regularly in CKD patients.

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Conflict of Interest

Authors declare conflict of interest.

References

1. Shamsuddin M, Baig M S A, Hemalatha, Kumari S. Thyroid dysfunctions in patients with chronic renal failure. Int J Biol Med Res. 2014; 5(1): 3911-14
2. Khajehdehi P , Malekmakan L , Pakfetrat M , Roozbeh J , Sayadi M. Prevalence of chronic kidney disease and its contributing risk factors in Southern Iran: a cross-sectional adult population-based study. Iran J Kidney Dis. 2014 :8: 2:109-115
3. Levey A S, Coresh J, Bolton K, et al. K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. Am J Kidney Dis. 2002;39 (2 suppl 1): S1-S266.
4. Mansourian, A.R. A review of literature on thyroid hormone disorders originated from extra thyroidal illness. J Biol Sci. 2014; 14 (1);20-37 [DOI:10.3923/jbs.2014.20.37]
5. Hizli Ş, Arsalan N, Abaci A, Buyukgebiz B. Subclinical hypothyroidism in obese Turkish adolescents: the relationship with anthropometry and fatty liver. Turk J Med Sci. 2010; 40 (2): 287-92
6. Bajaj S, Purwar N, Gupta A, Gupta P, Srivastava A. Prevalence of hypothyroidism in nondiabetic chronic kidney disease and effect of thyroxine replacement on estimated glomerular filtration rate. Indian J Nephrol. 2017; 27(2): 104-107 [DOI:10.4103/0971-4065.181464] [PMID] [PMCID]
7. Niemczyk S, Niemczyk L, Ciepielewska K R. Basic endocrinological disorder in chronic renal failure. Polish J Endocrinol. 2012; 63 (3): 250 - 57
8. Chonchol M, Lippi G, Salvagno G, Zoppini G, Muggeo M, Targher G. Prevalence of subclinical hypothyroidism in patients with chronic kidney disease. Clin J Am Soc Nephrol. 2008; 3: 1296-1300 [DOI:10.2215/CJN.00800208] [PMID] [PMCID]
9. Allawi A. Prevalence of hypothyroidism in chronic kidney disease among sample of Iraqi Patients. J Fac Med Baghdad. 2013; 55(2): 97-103
10. Yuasa R, Ohashi Y, Saito A, Tsuboi K, Shishido S, Sakai K. Prevalence of hypothyroidism in Japanese chronic kidney disease patients. Renal Failure. 2020; 42(1): 572-579 [DOI:10.1080/0886022X.2020.1777162] [PMID] [PMCID]
11. Chandra A. Prevalence of hypothyroidism in patients with chronic kidney disease: a cross-sectional study from North India. Kidney Res Clin Pract. 2016; 35(3):165-8. [DOI:10.1016/j.krcp.2016.06.003] [PMID] [PMCID]
12. Azami M, Parizad N, Sayehmiri K. Prevalence of hypothyroidism, hypoparathyroidism and the frequency of regular chelation therapy in patients with thalassemia major in Iran: A systematic review and meta-analysis study. Iran J Ped Hematol Oncol. 2016; 6 (4) :261-276
13. Pan B, Du X, Zhang H, Hua X, Wan X, Cao C. Relationships of chronic kidney disease and thyroid dysfunction in non-dialysis patients: A pilot study. Kidney Blood Press Res. 2019; 44:170-8 [DOI:10.1159/000499201] [PMID]
14. Aminorroaya A, Meamar R, Amini M, Feizi A, Tabatabae A, Imani EF. Incidence of thyroid dysfunction in an Iranian adult population: the predictor role of thyroid autoantibodies: results from a prospective population-based cohort study. Eur J Med Res. 2017; 22,21

[DOI:10.1186/s40001-017-0260-2] [PMID] [PMCID]

15. Demet Y, Siren S, Rahman Y, et al. Free triiodothyronine in hemodialysis patients link with malnutrition and inflammation. Iran J Kidney Dis. 2014 ; 8 (3); 212 - 17
16. Iglesias P, Diez JJ. Thyroid dysfunction and kidney disease. Eur J Endocrinol. 2009; 160(4): 503-15. [DOI:10.1530/EJE-08-0837] [PMID]
17. Cotoi L, Borcan F, Sporea I, et al. Thyroid pathology in end-stage renal disease patients on hemodialysis. Diagnostics. 2020; 10(4): 245 [DOI:10.3390/diagnostics10040245] [PMID] [PMCID]
18. Alsaran K, Sabry A, Alshahhat H, Babgy E, Alzahrani F. Free thyroxine, free triiodothyronine and thyroid-stimulating hormone before and after hemodialysis in Saudi patients with end-stage renal disease: Is there any difference?. Saudi J Kidney Dis Transpl. 2011; 22:917-21
19. Fan J, Yan P, Wang Y, Shen B, Ding F, Liu Y. Prevalence and clinical significance of low T3 syndrome in non-dialysis patients with chronic kidney disease. Med Sci Monit. 2016;22: 1171-79 [DOI:10.12659/MSM.895953] [PMID] [PMCID]
20. Emami N A, Darvishnia S, Khalili N, Norouzi Bazzaz A, Khazaei M, Shobeyri A. Thyroid function markers in patients receiving hemodialysis and peritoneal dialysis for chronic kidney disease. J Isfahan Med Sch. 2013; 31 (224): 59 -68
21. Zoccali C, Tripepi G, Cutrupi S, Pizzini P, Mallamaci F. Low triiodothyronine: A new facet of inflammation in end-stage renal disease. J Am Soc Nephrol. 2005; 16: 2789-95 [DOI:10.1681/ASN.2005040356] [PMID]
22. Jusufovic S, Hodzic E. Functional thyroid disorders are more common in patients on chronic hemodIalysis compared with the general population. Mater Soc. 2011; 23(4): 206-209 [DOI:10.5455/msm.2011.23.206-209] [PMID] [PMCID]
23. Zeraati AA, Layegh P, Famili Y, Naghibi M Sharifipour F, Shariati SZ. Serum triiodothyronine level as an indicator of inflammation in patients undergoing dialysis. Iran J Kidney Dis. 2011; 5(1): 38-44
24. Walsh JP, Bremner AP, Bulsara MK, et al. Subclinical thyroid dysfunction as a risk factor for cardiovascular disease. Arch Intern Med. 2005;165 :2467- 2472 [DOI:10.1001/archinte.165.21.2467] [PMID]
25. Hergenc G, Onat A, Albayrak S. TSH Levels in Turkish adults: Prevalences and associations with serum lipids, coronary heart disease and metabolic syndrome. Turk J Med Sci. 2005; 35: 297-304

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