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Effect of Chronic kidney disease on Thyroid function

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Abstract

Background: Chronic kidney disease results in downturn of glomerular filtration rate, which brings about nephropathic effect. The intensifying nephropathy muddles the thyroid functions and turns down the iodide clearance, thus expedites the hypothyroidism.
Objective: The study aimed to link chronic kidney disease with hypothyroidism.
Material and Methods: Our study design was cross-sectional. Chronic kidney disease patients were selected for thyroid profile (triiodothyronine, thyroxine and thyroid stimulating hormone) testing. Statistical analysis was consummated on collected data, to check out the correlation between CKD and hypothyroidism.
Results: We enrolled 105 patients suffering from CKD. Of them 62 were male patient and 43 were female. Our analysis concluded that 49, of whom 30 were male and 19 were female, had hypothyroidism. 23; 16 male and 7 female, were having subclinical hypothyroidism and low T3 was seen in 33 individuals, comprising of 16 male and 17 female patients.
Conclusion: It is evident that there is substantial effect of CKD over thyroid function, as hypothyroidism, subclinical hypothyroidism and low T3 syndrome are more frequent in CKD patients. To fend off CKD, the thyroid function needs to be kept under observation, so that a good prognosis could be gained.

Keywords: Chronic kidney disease, glomerular filtration rate, subclinical hypothyroidism, throxine, thyroid stimulating hormone

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Introduction

Chronic kidney disease (CKD) is known to drop down the glomerular filtration rate (GFR), which in turn, adds to increased risk of developing clinical and subclinical hypothyroidism (SCH), [1]. The prompt surge in diseases like diabetes mellitus, cardiovascular diseases, cancers, and chronic respiratory disease, is associated with unhealthy living status, increase of urban areas and changes in environment. Strikingly chronic kidney disease has not been included in this list. CKD is designated to as a consistent low glomerular filtration rate; measuring less than 60 ml per minute per 1.73m^2 of body surface, regardless of the root cause, affecting the kidneys. When glomerular filtration rate falls below 15 ml/min/1.73m^2 of body surface, it reflects “end stage. renal disease”. CKD has been categorized into five types, based on degree of kidney damage, from mild dysfunction to complete renal failure. CKD is deadly and majorly associated with morbidity and mortality around the globe[2].

The kidney contributes to thyroid function by metabolizing and excreting thyroid hormone. Thus,

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impaired renal function disturbs the thyroid function by disrupting production, metabolism, and excretion of thyroid hormone. The body maintenance of water and electrolyte homeostasis and renal growth and nourishment, also relie on the thyroid hormones3 Patients suffering from nephrotic syndrome, face the pathologic loss of thyroid hormones that brings about low thyroid hormone levels, unless the compensatory action of thyroid stimulating hormone (TSH) fulfils the requirement of thyroid hormone. Also, the body becomes deprived of thyroxin binding globulin (TBG) and hypoalbuminemia due to albumin losing nephropathy. Both events come up with declined binding capacity for the thyroid hormones, that ends up with fall of total triiodothyronine (T3) and total thyroxin (T4) levels 4.

The glomerular filtration, withinn kidneys, clears up the iodine. The chronic renal failure drops off the iodide elimination, leading to risen plasma concentration of inorganic iodide and its consequent uptake crops up. The rise in bodily inorganic iodide influences the pituitary-thyroid axis and take hold of peripheral metabolism of thyroid hormone (the Wollf-Chaikoff effect). In consequence, the synthesis of thyroid hormone is halted to a great extent.[5] These collective events that comme about in CKD, render the thyroid gland hypofunctional.

On condition that hypothyroidism is mechanically linked to CKD, it may show vital clinical hints for chronic renal disease patients. Hypothyroidism is highly prevalent, but easy to diagnose and easy to manage [6.7.]

Material and Method

This study was organized in the Department of Nephrology at Aziz Bhatti Shaheed Hospital. The total number of chronic kidney disease patients was 105.The duration of this study was from February 2022 to March 2023.Patients who had symptoms of chronic kidney disease, with elevated renal functions tests, were selected for study. To study the parameters including urea, creatinine and thyroid profile, blood samples were collected from these patients. Blood samples from CKD patients were collected in gel vial (3.5ml). Serum was obtained by the centrifugation of samples at 3500 rpm in 5 minutes.

Using Jaffe's method.[8], creatinine was measured in fully automated analyzer; "Selectra Pro M Lite" of Elite group. It automatically calculates the concentration of creatinine in serum. Serum urea was also analyzed in "Selectra Pro M Lite" of Elite group.

Estimation of T3,T4 and TSH: We used "I Chroma 3", Boditech, a Fluorescence Immunoassay (FIA) for the quantitative evaluation of thyroid profile.

Inclusion criteria:

Gender: Male and Female

Age: The age between 20 to 94 years

Chronic kidney disease patients

- Elevated blood urea,serum creatinine and decreased estimated glomerular filtration rate
- Patients with hypothyroidism
- Low T3 level

Exclusion criteria:

- Patients with hyperthyroidism
- Patients undergoing hormone replacement therapy

Results

Among 315 patients with increased serum creatinine, blood urea and 105 participants were selected based on inclusion and exclusion criteria. Acute kidney injury was not included. The age between 20 to 94 years. It was observed that out of 105 patients, 49 people had hypothyroidism, 33 participants were low T3 syndrome, and 23 patients were subclinical hypothyroidism.

Table 1 shows the analysis of thyroid dysfunction. In this study total 105 patients were included from which 62 patients were male and 43 females. Among males 30 patients were diagnosed with hypothyroidism ,16 patients had subclinical hypothyroidism and rest of 16 patients had low T3 syndrome. Seven of the 19 female patients with hypothyroidism were sub clinically hypothyroidism, while the remaining 17 patients had low T3 syndrome.

The patients were classified into five age categories for analysis. The first category included 13 patients aged

Gender * Type of Thyroid Crosstabulation

Count

		Type of Thyroid dysfunction			Total
		HypoThyroidism	SubClinical HypoThyroidism	Low T3	
Gender	Male	30	16	16	62
	Female	19	7	17	43
Total		49	23	33	105

20-34, of whom 6 were diagnosed with hypothyroidism, 2 were diagnosed with subclinical hypothyroidism, and 5 were diagnosed with low T3 levels. The second category included 58 patients aged 35-49, of whom 29 were diagnosed with hypothyroidism, 12 were diagnosed with subclinical hypothyroidism, and 17 were diagnosed with low T3 levels. The third category included 19 patients aged 50-64, of whom 9 were diagnosed with hypothyroidism, 6 were diagnosed with subclinical hypothyroidism, and 4 were diagnosed with low T3 levels. The fourth category included 13 patients aged 65-79, with 4 having diagnosis of hypothyroidism,3 having subclinical hypothyroidism and 6 exhibiting low T3 level. The fifth category included 2 patients aged 80-94, with 1 patient diagnosed with hypothyroidism, no cases of subclinical hypothyroidism were identified and 1 patient presenting low T3 level. However, the highest rate of thyroid dysfunction was found in age group 2. [35-49] patients.

According to Pearson's correlation test, the results creatinine has significant correlation with T3.T3 has significant correlation with creatinine and T4. T4 has a significant correlation with T3 and TSH. TSH is significantly correlated with T4.

Age Group (Years) * Type of Thyroid Crosstabulation

		Type of Thyroid dysfunction			Total
		HypoThyroidism	SubClinical HypoThyroidism	Low T3	
Age Group (Years)	20-34	6	2	5	13
	35-49	29	12	17	58
	50-64	9	6	4	19
	65-79	4	3	6	13
	80-94	1	0	1	2
Total		49	23	33	105

Discussion

There is extensive evidence showing that the functioning of the thyroid gland can be impacted by the kidneys, both in cases of good health and illness [9, 10].Hypothyroidism has shown that the functioning of the thyroid gland can affect the structure and function of the kidneys, both during development and adulthood. In animal studies, a decrease in the ratio of kidney weight to body weight, a reduction in tubular mass, changes in the structure of the glomerular, a decrease in signal nephron glomerular filtration rate, a low renal plasma flow, and lower glomerular transcapillary hydrostatic pressure have been observed in response to the condition being referred to [11-12]

The study population consisted of 441,485 individuals who underwent outpatient testing for serum TSH and creatinine levels. After excluding 63,384 patients who did not meet the study's criteria, a total of 378,101 individuals were included in the analysis.In Cohort study, 114,872 individuals (30.4%) had hypothyroidism, with 31,242 (27.2%) classified as having hypothyroid status and 83,630 (72.8%) having attenuated hypothyroidism. [13]

A study conducted in Jeddah; Saudi Arabia examined the prevalence of hypothyroidism in a single-center retrospective analysis. The results of the study indicated that that the prevalence of hypothyroidism in this population was 29.1%. [14]

A conducted study by Mal M, et al in Karachi has found that 20% 0f 158 patients with chronic kidney disease had subclinical hypothyroidism([15]).The study also revealed that there was a higher prevalence of subclinical hypothyroidism in individuals with reduced eGFR, regardless of their age and gender. These findings are consistent with those of a study conducted by Chonchol et al.[16] In our study, the rate of subclinical hypothyroidism was 21.90% in out of 105 individuals with chronic kidney disease.

Vikas BR et al, this study aimed to investigate the connection between thyroid problems and chronic kidney disease. Results showed that as chronic renal failure worsened, the levels of TT3, TT4, and FT3 reduced gradually. [17]

Shobhit Shakya et al, the study included 192 patients, with 124 males and 68 females. The results showed that there was a significant decrease in levels of T3, T4, and TSH in both sexes, indicating a higher prevalence of subclinical hypothyroidism and clinical hypothyroidism in patients with chronic kidney disease (CKD). As the eGFR decreased, the severity of thyroid hypofunction increased. The study also suggested that the cause of hypothyroidism in CKD patients may be different from the mechanism caused by anti-thyroid antibodies. [5]

Conclusion

We observed that thyroid abnormalities were seriousness attending in CKD patients, clinical hypothyroidism and low T3 syndrome was found in chronic kidney disease individuals. In future, further studies are required to investigate the correlation between chronic kidney disease and thyroid dysfunction.

This study is conducted on small sample size. Hence, a large sample size study must be conducted.

Conflict of Interest: No
Acknowledgement: No

References

1. Chandra A. Prevalence of hypothyroidism in patients with chronic kidney disease: a cross-sectional study from North India. Kidney research and clinical practice. 2016 Sep 1;35(3):165-8.
2. Kashif M, Hussain MS, Anis M, Shah PK, Siddiqui Sr MA. Thyroid Dysfunction and Chronic Kidney Disease: A Study Among the Northeastern Population of India. Cureus. 2023 May 8;15(5).
3. Vanani BL, Nasvantbhai D, Sharma H, Patel SR, Vasava S. Evaluation of thyroid hormones in chronic kidney disease patients at tertiary care hospital-A comparative study. International journal of clinical biochemistry and research. 2017 Apr;4(2):119-22.
4. Rajeev G, Rayappa WD, Vijayalakshmi R, Swathi M, Kumar S. Evaluation of thyroid hormone levels in chronic kidney disease patients. Saudi Journal of Kidney Diseases and Transplantation. 2015 Jan 1;26(1):90-3.
5. Shakya S, Kumar S, Verma V, Gupta H, Sonkar SK, Atam V. Evaluation of Interactions Between Thyroid Dysfunction in End-Stage Renal Disease Patients: A Cross-Sectional Study. Cureus. 2023 Feb 16;15(2).
6. Hollowell JG, Staehling NW, Flanders WD, Hannon WH, Gunter EW, Spencer CA, Braverman LE. Serum TSH, T4, and thyroid antibodies in the United States population (1988 to 1994): National Health and Nutrition Examination Survey (NHANES III). The Journal of Clinical Endocrinology & Metabolism. 2002 Feb 1;87(2):489-99.
7. Garber JR, Cobin RH, Gharib H, Hennessey JV, Klein I, Mechanick JI, Pessah-Pollack R, Singer PA, Woeber for the American Association of Clinical Endocrinologists and American Thyroid Association Taskforce on Hypothyroidism in Adults KA. Clinical practice guidelines for hypothyroidism in adults: cosponsored by the American Association of Clinical Endocrinologists and the American Thyroid Association. Thyroid. 2012 Dec 1;22(12):1200-35.
8. Bhatele P, Dasgupta A, Ghosh A, Das S, Bhattacherjee S. Evaluation of Thyroid Dysfunction in Patients of Chronic Kidney Diseases.
9. Lo JC, Chertow GM, Go AS, Hsu CY. Increased prevalence of subclinical and clinical hypothyroidism in persons with chronic kidney disease. Kidney international. 2005 Mar 1;67(3):1047-52.
10. Chonchol M, Lippi G, Salvagno G, Zoppini G, Muggeo M, Targher G. Prevalence of subclinical hypothyroidism in patients with chronic kidney disease. Clinical Journal of the American Society of Nephrology. 2008 Sep 1;3(5):1296-300.
11. Rodriguez-Gomez I, Banegas I, Wangensteen R, Quesada A, Jiménez R, Gómez-Morales M, O'Valle F, Duarte J, Vargas F. Influence of thyroid state on cardiac and renal capillary density and glomerular morphology in rats. J Endocrinol. 2013 Jan 2;216(1):43-51.
12. Bradley SE, Coelho JB, Sealey JE, Edwards KD, Stephan F. Changes in glomerulotubular dimensions, single nephron glomerular filtration rates and the renin-angiotensin system in hypothyroid rats. Life sciences. 1982 Feb 1;30(7-8):633-9.
13. Huang CW, Li BH, Reynolds K, Jacobsen SJ, Rhee CM, Sim JJ. Association between hypothyroidism and chronic kidney disease observed among an adult population 55 years and older. Medicine. 2020 Apr;99(17).
14. Aljabri KS, Alnasser IM, Facharatz BS, Bokhari SA, Alshareef MA, Khan PM. The frequency of hypothyroidism in Saudi community-based hospital: A retrospective single centre study. Trends Diabetes Metab. 2019;2(1):1-4.
15. Kumar D, Mal P, Kumar D, Junejo AM, Memon HN, Talpur AS, Ayyaz M, Baloch ZA. Subclinical hypothyridism in patients with chronic kidney disease visiting at tertiary care hospital, Karachi. INDO AMERICAN JOURNAL OF PHARMACEUTICAL SCIENCES. 2017 Oct 1;4(10).
16. Chonchol M, Lippi G, Salvagno G, Zoppini G, Muggeo M, Targher G. Prevalence of subclinical hypothyroidism in patients with chronic kidney disease. Clinical Journal of the American Society of Nephrology. 2008 Sep 1;3(5):1296-300.
17. BR V, Raghav GN, Kumar S. Study of thyroid profile in patients with Chronic Kidney Disease: a cross sectional study.