Section: Medicine

Original Research Article

STUDY OF THYROID PROFILE AND IT'S ASSOCIATION IN PATIENTS WITH UNDIALYZED CHRONIC KIDNEY DISEASE

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Received : *30/04/2023*
Received in revised form : *28/05/2023*
Accepted : *10/06/2023*

Keywords:
Chronic kidney disease, thyroid, glomerular filtration rate, Thyroid dysfunction, thyrotropin releasing hormone.

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DOI: 10.47009/jamp.2023.5.3.351

Source of Support:Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5(3); 1762-1768

Abstract

Background: The prevalence of decreased renal function among those with chronic kidney disease (CKD) is rising quickly. Numerous comorbidities, such as thyroid dysfunction, dyslipidemia, and cardiovascular illnesses, are linked to the progression of CKD. The purpose of this study was to look into CKD patients' thyroid profiles. **Materials and Methods:** A prospective cohort study was conducted in the Department of Medicine, Darbhanga Medical College Hospital Laheriasarai, Darbhanga. Demographic features (age and sex) of each patient were noted, and blood samples were analyzed for serum urea, creatinine, low serum T3 levels, normal TSH, and free T4 levels are symptoms of low T3 syndrome. **Results:** The correlation among the values of G2, G3a, G3b G4 and G5 was observed to be statistically significant. Highest number male and female was found to be associated with G4 GFR and G5 GFR category respectively. Mean blood urea in G3b, G4 and G5 group patients was comparatively higher than other group. Only 15 (30%) patients were shown normal thyroid profile, remaining 35 (70%) patients were found to be suffering from any kind of thyroid problem. **Conclusion:** Thyroid dysfunction is common in CKD patients. Progression of CKD is accompanied by rise in hypothyroidism in this study.

INTRODUCTION

Chronic kidney disease (CKD) is a collective term for a variety of pathophysiological conditions characterized by impaired kidney function and a steadily declining glomerular filtration rate (GFR). Due to the buildup of different protein nitrogenous compounds, multiple clinical processes in CKD ultimately lead to the loss of renal metabolic, excretory, endocrine, and synthetic activities.[1]

A wide range of cardiovascular illnesses are the common cause of mortality in CKD patients. Patients with CKD in the age range of 25 to 34 years had a 500-fold higher prevalence of cardiovascular morbidity than non-CKD patients in the same age range and race.

Thyroid dysfunction affects renal physiology and development, whereas kidney disease could result in thyroid dysfunction. Disorders of the thyroid and kidney may co-exist with common etiological factors. In addition, treatment strategies of one disease may affect those of the other organ.[2]

The body's electrolyte and water balance is impacted by hormones. Thyroid hormones are involved in renal growth, hence they play a significant part in renal physiology. Reduced iodothyronines are linked to lower GFR, reduced blood flow to the kidneys, and altered tubular reabsorption, which results in lower water excretion. Contrarily, thyrotoxicosis results in polyuria due to increased tubular reabsorption and glomerular filtration.[3]

Thyroid hormones are processed and removed by the kidney, which also has a crucial role in several of the actions thyroid hormones take. As a result, changes in thyroid hormone levels are related to deteriorating renal function.

It is crucial to take into account the physiological relationship between thyroid dysfunction and chronic renal disease since thyroid hormones have a substantial impact on kidney disease (CKD). The peripheral thyroid hormone metabolism and the pituitary-thyroid axis are both impacted by CKD.[3]

In people with CKD, primary hypothyroidism is frequent. Particularly, a drop in estimated glomerular filtration rate (eGFR) is consistently associated with an increase in the incidence of subclinical hypothyroidism.[4]

The majority of thyroid hormones in the blood are protein-bound, which can be problematic in chronic kidney disease. Patients with CKD have inhibitors that stop thyroid hormones from attaching to proteins.

ISSN(O): 2687-5365; ISSN(P): 2753-6556

A "low T3 syndrome" is the earliest and most prevalent thyroid function impairment in CKD patients. However, the free T4 levels fluctuate between low and normal, mostly due to poor T4 protein binding. The thyroid profile is comparable to that seen in a number of nonthyroidal illnesses (NTIs), including serious infections, heart failure, cancer, and a number of hospitalized individuals without renal disease. Due to this, the idea of a "sick euthyroid condition" in CKD—now known as "nonthyroidal illness"—was considered. The total rT3 levels in CKD patients do not rise, in contrast to other NTI states.[5] TSH levels are raised, which is another distinction between this NTI and other NTIs.

As a result, CKD patients have low T3, normal or reduced T4, increased TSH, and an accompanying rise in thyroid gland volume.[6]

The decreased T3 levels and related complications without an increase in rT3, the decreased free T4 levels along with an elevated TSH, and the hyperresponsiveness of TSH to thyrotropin releasing hormone call into question the "euthyroid" state and suggest that thyroid supplementation may be advantageous in CKD. Current recommendations are still divided on whether or not to treat subclinical hypothyroidism.[7]

Several researchers have identified euthyroid, hyperthyroid, and hypothyroid states in patients with chronic renal disease. According to published research, thyroid hormone function tests in CKD patients receiving long-term dialysis demonstrate a considerable modification. But in patients getting conservative therapy without dialysis, little is described. Therefore, it is crucial to comprehend how kidney function and thyroid hormone levels interact.

MATERIALS AND METHODS

Materials Study design

A prospective cohort study was conducted to study the thyroid profile and its association in patients with undialysed CKD in the Department of Medicine, Darbhanga Medical College Hospital Laheriasarai, Darbhanga.

Study place

Total of 50 subjects for 12 months were selected both male and female from Outpatient Department (OPD), In Patient Department (IPD) and Medical Intensive Care Unit (MICU) of Department of Medicine, Darbhanga Medical College Hospital Laheriasarai, Darbhanga. The subjects were selected based on the inclusion and exclusion criteria. Those who were not willing to give consent for the study & too ill to participate were excluded in our study.

The approval for conducting the study was taken from the institutional ethics committee. After explaining details about the study involved, an informed consent was taken in their native language from the concerned participant or representative in case the patient is not able to provide consent.

Inclusion Criteria

The patients who fulfill the criteria for chronic kidney disease and who are on conservative management not undergoing renal replacement therapy:

1. Patients of CKD
2. Age >14 years
3. Both sex

Criteria for CKD (either of the following present for > 3 months)

Markers of kidney damage

- Albuminuria (AER ≥ 30 mg/24 hours; ACR ≥ 330 mg/g)
- Urine sediment abnormalities
- Electrolyte and other abnormalities due to tubular disorders
- Abnormalities detected by histology
- Structural abnormalities detected by imaging
- History of kidney transplantation

Decreased GFR - GFR < 60 ml/min/1.73 m2

Exclusion Criteria

1. Age <14 years
2. Pregnant patients
3. CKD patients receiving dialysis (haemodialysis or peritoneal dialysis)
4. Patients diagnosed previously with thyroid disorders (hypothyroidism or hyperthyroidism)
5. Nephrotic range of proteinuria
6. Patients receiving drugs that alter thyroid profile (thyroxin supplementation), iodine containing drugs (amiodarone), anti-thyroid drugs (carbimazole), Phenytoin, Beta blockers and Oestrogen pills.
7. Acute illness & ICU admission
8. Recent Surgery or trauma.

Investigation on Presentation

Detailed history and undertaken examination with special focus on thyroid & renal system. Following investigations to be used:

1. Urine for specific gravity and microscopic examination
2. Peripheral smear
3. Blood urea, Serum Creatinine levels, creatinine clearance (Cockcroft and Gault formula)
4. 24 hours urine protein and serum proteins to rule out Nephrotic Syndrome and Hypoproteinaemia, respectively.
5. Serum electrolytes including calcium and phosphorous
6. USG abdomen for evidence of Chronic Renal Failure.

After selecting the patients fulfilling above criteria, 5ml of blood was collected in non-heparinized serum bottles and sent for quantitative evaluation of thyroid profile by Electro chemiluminescenceimmunoassay method —

Categorization of Thyroid Abnormality

Low serum T3 levels, normal TSH, and free T4 levels are symptoms of low T3 syndrome. Patients

ISSN(O): 2687-5365; ISSN(P): 2753-6556

with serum TSH values over 4.20 and normal levels of free T4 are said to have subclinical hypothyroidism. Patients with serum TSH levels above 4.20 and free T4 concentrations below 0.8 ng/dL are considered to have hypothyroidism. Hyperthyroidism—Patients with Serum TSH 0.5 IU/mL. Patients who have subclinical hyperthyroidism and serum TSH levels below 0.5 IU/mL with normal free T4 levels.

Interpretation of the Thyroid Profile Test results

- Low T4 and T3 along with high TSH level indicates hypothyroidism. The most common cause of hypothyroidism is Hashimoto thyroiditis
- High T4 and T3 along with low TSH indicate hyperthyroidism. The most common cause of hyperthyroidism is Grave's disease
- Normal thyroxine (T4) and T3 along with high TSH usually indicates mild or subclinical hypothyroidism
- Normal T3 and T4 along with low TSH indicates mild or subclinical hyperthyroidism

Statistical Analysis

A Master Chart was used to record the information collected on all the selected subjects. Data was analyzed for proportion of thyroid dysfunction in chronic kidney disease patients and correlation of thyroid dysfunction with creatinine clearance.

The Statistical Package for the Social sciences (SPSS) (v25, SPSS Inc., Chicago. IL, USA) and Microsoft Excel 2016 (Microsoft Corporation, NY, USA) were used for all statistical analysis. Frequencies, percentages, means, standard deviations (S.D.) were computed using this software. Based on the number of test group either Unpaired t-test or one-way ANOVA were applied to calculate the p'value. A significant relationship is deemed to exist when the "p" value is less than 0.05.

RESULTS

Age and Gender Distribution

Total 50 subjects were included in this study based on inclusion and exclusion criteria. The age of patients was ranged from 19-73 years with mean age 47.74 ± 13.11 years. The patients were grouped in various age groups. The higher incidence of CKD was observed in 55-64 year age group, while lowest incidence was observed among 15-24 year age group.

Mean serum creatinine level was significantly high among all age groups than the normal range (for men = 0.74 to 1.35 mg/dL; for adult women, 0.59 to 1.04 mg/dL). The correlation between the age distribution and raised serum creatinine level was statistically significant i.e. $P < 0.05$. Out of these, 16 patients were female with mean serum creatinine 3.19 ± 1.23 mg/dL, and 34 patients were male with 2.72 ± 1.08 mg/dL mean serum creatinine level.

Stages of Chronic Kidney Disease based on GFR

Glomerular filtration rate (GFR) was calculated according to the 'Variable MDRD study equation' as follows.

$$GFR = 175 \times Serum\ Creatinine^{-1.154} \times Age^{-0.203} \times 0.742\ (if\ women)$$

Total of 20 patients were to associated with severely decreased GFR (G4) while least number of patients were found in G2 GFR categories (mildly decreased GFR) (Figure 1). G3a GFR categories (mildly to moderately decreased) in 4 patients, G3b GFR categories (moderately to severely decreased) in 14 patients, and G5 GFR categories (kidney failure) in 9 patients. The mean age and GFR categories were observed to be statistically significant.

CKD Prevalence across the gender and age distribution

Average age of G2 GFR category, G3a GFR category, G3b GFR category, G4 GFR category and G5 GFR category was 47.33±13.2 years, 42.5±11.9 years, 48.1±15.3 years, 45.4±13.8 years and 54.9±5.8 years, respectively. The correlation among the values of G2, G3a, G3b G4 and G5 was observed to be statistically significant i.e. P = 0.00018 (via Single factor ANOVA).

In case of male group, G2 GFR category in 3 patients, G3a GFR category in 3 patients, G3b GFR category in 12 patients, G4 GFR category in 14 patients, and G5 GFR category in 2 patients was found. Highest number male was found to be associated with G4 GFR category.

In case of female group, G2 GFR category in 0 patients, G3a GFR category in 1 patients, G3b GFR category in 2 patients, G4 GFR category in 6 patients, and G5 GFR category in 7 patients was found. Highest number female was found to be associated with G5 GFR category.

Distribution of Blood Urea and serum in CKD

Blood urea refers to the concentration of urea in the blood. Urea is the main nitrogenous excretory matter in mammals, including humans. They have a higher nitrogen composition in comparison to the other nitrogenous waste compounds such as uric acid and ammonium. Mean blood urea in G3b, G4 and G5 group patients was comparatively higher than other group (Table 1). Also, the values among blood urea and GFR categories was statistically significant (p = 0.0002).

Serum creatinine (SCr) levels are frequently used as a screening test to assess impaired renal function. A creatinine test is a measure of how well your kidneys are performing their job of filtering waste from your blood. The typical range for serum creatinine is: For adult men, 0.74 to 1.35 mg/dL, for adult women, 0.59 to 1.04 mg/dL. Serum creatinine was used to calculate the GFR. Serum creatinine was continuously increasing with CKD grades (Figure 2).

ISSN(O): 2687-5365; ISSN(P): 2753-6556

Thyroid Profile

Thyroid profile tests are a series of blood test used to measure how well your thyroid gland is working. Available tests include the Total T3, Free T3, Total T4, Free T3 and TSH. The GFR range of total T3, T4; free T3, T4 and TSH mean ± S.D. value for these hormones is shown in Table 2.

Based on following categorization of thyroid abnormality, the patients are grouped in thyroid profile.

- Low T3 Syndrome— Patients with low serum T3 levels and normal TSH and Free T4.
- Subclinical Hypothyroidism— Patients with Serum TSH > 4.20 and normal Free T4 levels.
- Hypothyroidism—Patients with Serum TSH > 4.20 and Free T4 < 0.8 ng/dL.
- Subclinical Hyperthyroidism—Patients with Serum TSH < 0.5 µIU/mL and normal Free T4 levels.
- Hyperthyroidism—Patients with Serum TSH < 0.5 µIU/mL and Free T4 > 1.8 ng/dL.

Only 15 patients (30%) were shown normal thyroid profile, remaining 35 patients (70%) were found to be suffering from any kind of thyroid problem. Out these 70% patients, most of the patients (n = 19) were suffering from Low T3 syndrome. Least number of patients (n = 2) were diagnosed with subclinical hyperthyroidism. Nine patients were diagnosed with hypothyroidism and five with subclinical hypothyroidism. All relationship between creatinine clearance with all low, normal and high level profile are depicted in Table 3.

Total Serum Protein

The total protein test measures the total amount of two classes of proteins (albumin and globulin) found in the serum. Albumin helps prevent fluid from leaking out of the blood vessels. Globulin is an important part of your immune system. A low total protein level can suggest: -liver disease, kidney disorder, malabsorption, malnutrition etc. A high total protein may be seen with chronic inflammation or infection (viral hepatitis or HIV) and bone marrow disorders. Normal serum protein ranges from 6-8.3 g/dL. The serum protein ranges of admitted patients (6.1-8.2 g/dL) were found in normal range. Mean serum protein for each CKD grades are shown in Table 4. Statistically significant difference was observed among their values for different class of CKD grades.

Average 24hr Urinary Protein and urine Specific Gravity

A 24-hour urine collection helps diagnose kidney problems. It is often done to see how much creatinine clears through the kidneys. Urine specific gravity is a laboratory test that shows the total concentration of all chemical particles in the urine. The normal range for urine specific gravity is 1.005 to 1.030. The urine specific density range for admitted patients (1.011 to 1.029) was found in normal range. Statistically significant difference was observed for its value among the various CKD grades. Mean urine specific density for each CKD grades are shown in Figure 3, 4.

Corticomedullary Differentiation (CMD) and Echogenicity Grade

Renal cortical echogenicity was compared and graded with the echogenicity of the liver and renal medulla.

- Grade 0: Normal echogenicity less than that of the liver with sustained cortico-medullary differentiation.
- Grade 1: The cortico-medullary differentiation is still intact, and the echogenicity is identical to that of the liver.
- Grade 2: Maintaining cortico-medullary differentiation and more echogenicity than the liver.
- Grade 3: Poorly maintained cortico-medullary differentiation and higher echogenicity than the liver.
- Grade 4: Loss of cortico-medullary differentiation and increased echogenicity compared to the liver.

The increased renal cortical echogenicity was reported in all the patients with CKD. Grade 1 echogenicity in 10 (20%) cases, Grade 2 in 29 (58%) cases, and Grade 3 in 11 (22%) cases was observed (Figure 5). The mean serum creatinine values were 3.14±1.01mg/dL for Grade 1 echogenicity, 2.85±1.17 mg/dL for Grade 2, and 2.68±1.23 mg/dL for Grade 3 echogenicity. Statistical significant correlation was observed between echogenicity grade and serum creatinine concentration.

Corticomedullary differentiation was normal in 2 patients (4%) of the cases, partially blurred in 22 patients (44%) of the cases and it was blurred in 26 (52%) of the cases (Figure 6). The mean serum creatinine values were 1.55±0.35 mg/dL for intact CMD, 3.18±1.17 mg/dL for partially blur CMD, and 2.71±1.07 mg/dL for blur CMD. In this case statistically significant relationship was observed between the mean Serum Creatinine level and corticomedullary differentiation status.

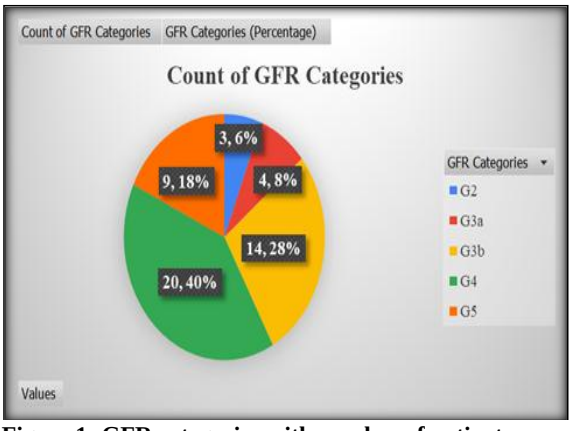

Figure 1: GFR categories with number of patients

ISSN(O): 2687-5365; ISSN(P): 2753-6556

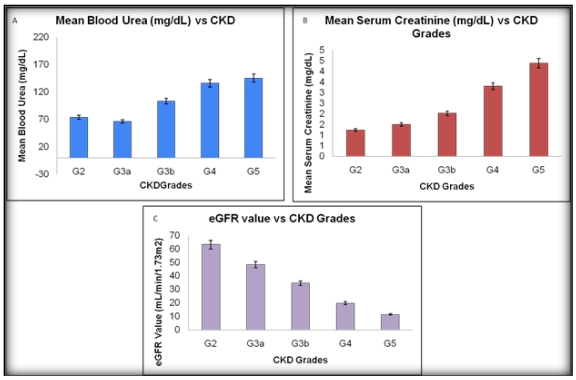

Figure 2: Distribution of blood urea, serum creatinine, eGFR across the CKD grades

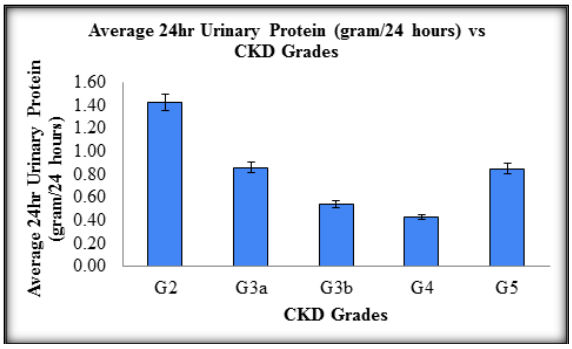

Figure 3: Average 24hr urinary protein concentration for different class of CKD grades

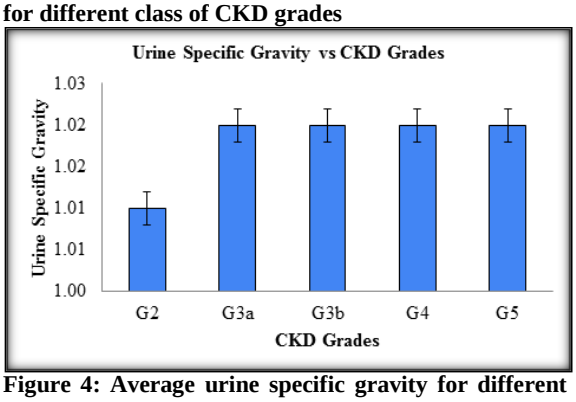

Figure 4: Average urine specific gravity for different class of CKD grades

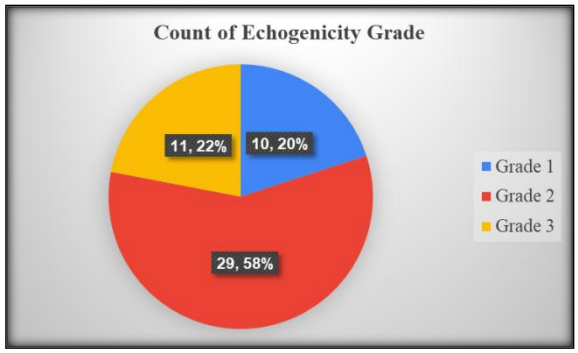

Figure 5: Renal cortical echogenicity and affected individuals

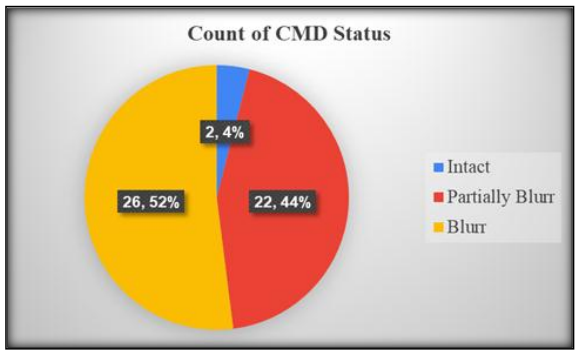

Figure 6: Renal corticomedullary differentiation count

Table 1: Distribution of blood urea Serum Creatinine and eGFR across the CKD grades

GFR Categories	Mean Blood Urea (mg/dL)	SD	Mean Serum Creatinine (mg/dL)	SD	Mean eGFR (mL/min/1.73 m^2)	SD
G2	74.33	22.19	1.23	0.06	63.21	1.10
G3a	66.50	30.16	1.50	0.18	48.36	6.28
G3b	103.71	43.06	2.03	0.21	34.65	4.02
G4	136.30	51.91	3.30	0.74	19.81	4.42
G5	145.67	60.72	4.39	0.58	11.43	1.90
P value	p = 0.0002; Single factor ANOVA		P = 0.0001; ordinary one-way ANOVA		P = 0.0001; ordinary one-way ANOVA	

Table 2: GFR categories with average value of Total T3, Free T3, Total T4, Free T3 and TSH

GFR Categories	N	Total T3 (Mean±S.D.)	Total T4 (Mean±S.D.)	Free T3 (Mean±S.D.)	Free T4 (Mean±S.D.)	TSH (Mean±S.D.)
G2	3	81.67±16.26	4.98±0.63	1.46±0.35	0.84±0.11	1.48±0.95
G3a	4	71.5±36.95	4.24±2.41	1.33±0.49	0.79±0.39	1.71±1.19
G3b	14	73.69±24.83	5.39±1.21	1.45±0.34	1.01±0.25	1.21±1.16
G4	20	87.75±34.62	5.85±1.52	1.91±0.71	1.09±0.23	1.81±1.51
G5	9	78.44±33.58	5.71±2.05	1.63±0.69	1.01±0.34	2.23±3.09

ISSN(O): 2687-5365; ISSN(P): 2753-6556

Table 3: Relationship between creatinine clearance with all low, normal and high level profile

Creatinine Clearance (mL/min/1.73 m2)		60-89	30-59	15-29	< 15
Serum TSH (µIU/mL)	Low	0	2	0	1
	Normal	2	11	15	6
	High	1	5	5	2
Free T3 (pg/mL)	Low	3	14	12	8
	Normal	0	4	8	1
	High	-	-	-	-
Free T4 (ng/dL)	Low	1	5	2	2
	Normal	2	13	18	7
	High	-	-	-	-
Total T3 (ng/dL)	Low	1	14	9	6
	Normal	2	13	18	7
	High	-	-	-	-
Total T4 (µg/dL)	Low	1	5	2	1
	Normal	2	13	18	8
	High	-	-	-	-

Table 4: Serum protein, average 24 hr urinary protein and urine specific gravity for different class of CKD grades

GFR Categories	Serum Protein (Mean±S.D.) (g/dL)	Average 24hr Urinary Protein (Mean±S.D.) (gram/24 hours)	Urine Specific Gravity (Mean±S.D.) (gm/mL)
G2	7.03±1.01	1.43±0.49	1.01±0
G3a	6.9±0.51	0.86±0.94	1.02±0
G3b	6.99±0.74	0.54±0.79	1.02±0
G4	7.16±0.46	0.43±0.63	1.02±0.01
G5	6.94±0.59	0.85±0.9	1.02±0.01
	p = 0.0003 Significant Correlation	p = 0.0008 Significant Correlation	p = 0.00019 Significant Correlation

DISCUSSION

A prospective cohort study, 50 patients who fulfil the criteria for chronic kidney disease (GFR < 60 ml/min/1.73 m2) were selected based on the inclusion and exclusion criteria over a period of 12 months. This study was conducted to study the role of thyroid hormone on the chronic kidney disease. We purposefully did not include CKD patients on dialysis in the current study because, as Rhee C. M. et. al.[8] and Ramirez G. et. al.[9] have shown, dialysis in CKD patients independently affects thyroid hormones. Knowing the frequency of thyroid dysfunction in CKD patients is important because hypothyroidism is linked to increased cardiovascular problems and mortality.[10] Glomerular filtration rate (GFR) was calculated according to the 'Variable MDRD study equation. It was observed that most of the patients (40%) were diagnosed with severely decreased renal function or G4 GFR categories. Only 6% patients were found with mildly decreased renal function, i.e. G2 GFR categories. Average age of patients in each GFR categories were around the mean age (47.74 ± 13.[11] years) and also statistically significant difference was observed. Similarly, mean blood urea in G3b, G4 and G5 group patients was comparatively higher than other group, with statistical significant difference was observed among their values. We found that 70% of CKD patients had thyroid dysfunction and 30% had normal thyroid status. Low T3 syndrome was the commonest dysfunction (with 38% cases) that occurred in CKD patients on conservative management which is consistent with studies.[9,11,12] 10% of the CKD patients in our research showed subclinical hypothyroidism. According to a recent study by Choncholet al.[13] subclinical hypothyroidism affected 18% of CKD patients receiving conservative treatment. According to Lo, J. C. et. al.[4] 23% of patients with eGFR 30 had hypothyroidism, and 56% of all hypothyroid cases fell into the category of subclinical hypothyroidism. About 18% CKD patients were reported with hypothyroidism and 4% diagnosed with subclinical hyperthyroidism. According to a thorough study by Kaptein E.M. et. al.[14] people with CKD are around 2.5 times more likely to have primary hypothyroidism than the general population. According to a research by Quion-Verde, H.[15] 5% of ESRD patients had hypothyroidism. Other kidney function health marker like, total serum protein, average 24hr urinary protein and urine specific gravity was also measured. Also significant statistical correlation was observed between these markers and GFR categories. Renal cortical echogenicity was compared and graded with the echogenicity of the liver and renal medulla. 58% CKD patients were found with Grade 2 echogenicity, i.e., Echogenicity greater than that of the liver.[11] CKD patients (22%) were grouped into Grade 3 echogenicity, while 20% are reported with Grade 1 echogenicity. Important point was positive significant difference was observed for serum creatinine level among the three grades, i.e., Grade 1, and Grade 2 and Grade 3. Corticomedullary differentiation was normal in 2 patients (4%) of the cases, partially blurred in 22 patients (44%) of the cases and it was blurred in 26

ISSN(O): 2687-5365; ISSN(P): 2753-6556

(52%) of the cases. The mean serum creatinine values were 1.55±0.35 mg/dL for intact CMD, 3.18±1.17 mg/dL for partially blur CMD, and 2.71±1.07 mg/dL for blur CMD. In this significant relationship was observed between the mean Serum Creatinine level and corticomedullary differentiation status. In their study, Chonchol et al. and Lo, J. C. et. al.[4,13] showed an inverse correlation between the prevalence of subclinical hypothyroidism and the stage of CKD. According to the Chonchol et al study, when the eGFR was over 90 and below 60, respectively, the prevalence of subclinical hypothyroidism increased from 7% to 17.9%.

Similar results were also shown by Lo J.C. et. al.[4] In their study, individuals with eGFR> 90 ml/min/1.73 m had a frequency of subclinical hypothyroidism of 5.4%, whereas those with eGFR 30 ml/min/1.73 m had a prevalence of 23%.

CONCLUSION

Among patients, CKD and thyroid diseases are two of the most common medical conditions. It is crucial to take into account the physiological relationship between thyroid dysfunction and kidney illness given the high occurrence of both. Total 50 CKD patients with raised serum creatinine was chosen and GFR was calculated. 40% patients were found with severely decreased GFR. Significant difference was observed between the mean blood urea value and varioud GFR categories. 70% of CKD patients had thyroid dysfunction and 30% had normal thyroid status. Low T3 syndrome was the commonest dysfunction (with 38% cases) that occurred in CKD patients.10% of the CKD patients in our research showed subclinical hypothyroidism. About 18% CKD patients were reported with hypothyroidism and 4% diagnosed with subclinical hyperthyroidism. Significant correlation was observed between severity of kidney disease and thyroid hormone level. Other kidney function health marker like, total serum protein, average 24hr urinary protein and urine specific gravity was also measured. Also positive correlation was observed between these markers and GFR categories. 58% CKD patients were found with Grade 2 echogenicity, i.e., Echogenicity greater than that of the liver. Total 11 CKD patients (22%) were grouped into Grade 3 echogenicity, while 20% are reported with Grade 1 echogenicity. Corticomedullary differentiation was normal in 2 patients (4%) of the cases, partially blurred in 22 patients (44%) of the cases and it was blurred in 26 (52%) of the cases. The mean serum creatinine values were 1.55±0.35 mg/dL for intact CMD, 3.18±1.17 mg/dL for partially blur CMD, and 2.71±1.07 mg/dL for blur CMD.

Acknowledgements

The authors thank the patients who participated and the staffs at the clinical centre. The authors thank Aziz Writing Solutions for assisting in manuscript preparation and publication.

Declaration of Conflicting Interests

The Authors declare that there is no conflict of any interest.

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ISSN(O): 2687-5365; ISSN(P): 2753-6556