International Journal of Research in Medical Sciences
Jha DK et al. Int J Res Med Sci. 2020 Sep;8(9):3284-3287
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20203679

Original Research Article

Occurrence of subclinical and overt hypothyroidism among chronic kidney disease patients

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Received: 14 July 2020
Accepted: 08 August 2020

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ABSTRACT

Background: Chronic kidney disease (CKD) is one of the vital health problems worldwide leading to increased global morbidity and mortality. Thyroid dysfunction including hypothyroidism, hyperthyroidism and non-thyroidal illness has been reported in CKD patients. This study was conducted to determine the prevalence of subclinical and overt hypothyroidism among chronic kidney disease patients. This study also tried to correlate thyroid function abnormalities with severity of renal failure.
Method: In this observational and cross sectional study, 100 patients of CKD who were admitted in Department of Medicine, Rajendra institute of medical sciences, Ranchi were studied for thyroid function abnormalities.
Result: This study found that glomerular filtration rate (GFR) is positively correlated with serum T3 and T4 level (i.e. with decreasing renal function both T3 and T4 levels decreased). Serum creatinine levels were negatively correlated with serum T3 and T4 level.
Conclusions: From this study it was established that CKD is associated with thyroid dysfunction characterized by low serum fT3 and fT4 with high TSH in some cases.

Keywords: Chronic kidney disease, Glomerular filtration rate, Overt hypothyroidism, Subclinical hypothyroidism, Thyroid dysfunction

INTRODUCTION

CKD infers long-standing, and usually progressive impairment in renal function developing over a period of days or weeks resulting in decline in GFR.[1,2] CKD is one of the vital health problems worldwide leading to increased global morbidity and mortality. Prevalence of this disease is increasing exponentially thus constitutes a major health priority worldwide. Thyroid hormones have impact on renal growth and development, renal hemodynamic, GFR, and sodium and water homeostasis. Kidney also involve in the metabolism and excretion of thyroid hormones. Early identification and management of CKD has been shown to reduce the adverse outcomes which include kidney failure and cardiovascular disease.

Thyroid dysfunction including hypothyroidism, hyperthyroidism and non-thyroidal illness has been reported in CKD patients. Non thyroidal illness or low T3 syndrome has been shown to worsen CKD by increasing cardiovascular morbidity and mortality and has been reported as an independent predictor of the cardiovascular mortality in these CKD patients.

There is need to determine the thyroid hormone profiles in the CKD patients and thus prevent the adverse outcomes. This study was conducted to determine the prevalence of subclinical and overt hypothyroidism among chronic kidney disease patients and it tried to correlate thyroid function abnormalities with severity of renal failure.

METHOD

In this observational and cross sectional study, 100 patients of CKD who were admitted in Department of Medicine, Rajendra institute of medical sciences, Ranchi were studied for thyroid function abnormalities.

Inclusion criteria

The criteria were patients who fulfilled the criteria for CKD. Criteria for Chronic Kidney Disease: Presence of uremic symptoms for 3 months or more, Raised blood urea, serum creatinine and reduced creatinine clearance, Ultra-sonographic evidence of chronic kidney disease-Bilateral contracted kidneys -size less than 9 cm, Poor Cortico-medullary differentiations, Supportive laboratory evidence of CKD like anaemia and changes in serum electrolytes etc.

Exclusion criteria

Patients with nephrotic range of proteinuria, hypoalbuminemia and other conditions like acute illness, diabetes mellitus, recent surgery, trauma, burns, liver diseases and drugs altering thyroid profile like amiodarone, phenytoin, beta-blocker, dopamine, steroids, estrogen pills and iodine containing drugs were excluded from study.

CASE REPORT

Age of our study population ranged from 27-77 years. Male patients were 81 accounting 81% and female patients were 19 accounting 19%. Duration of CKD symptoms ranged from 1 month to 72 months, the mean being 5.4 months. GFR ranges from 2 ml/min/1.73 m^2-47 ml/min/1.73 m^2. Blood urea values varied from 58 - 312 mg/dl, the mean value being 177.83 mg/dl. Serum creatinine levels varied from 1.8-19.2 mg/dl, the mean value being 8.28 mg/dl. Mean vitamin D level was 21.03 ng/ml.

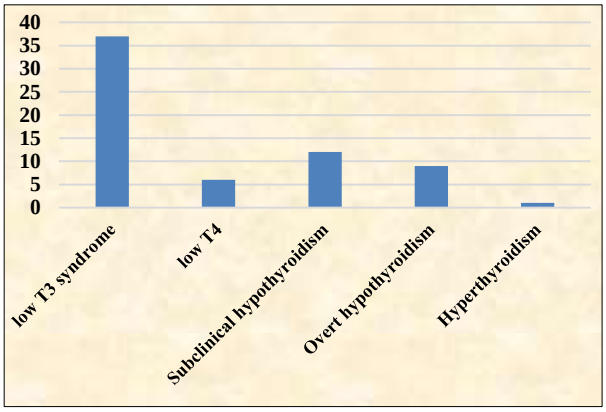

Figure 1: Distribution of thyroid dysfunction in CKD.

T3 values varied from <1.00 to 9.22 pg/ml and the mean value being 1.86 (normal range 1.7-3.71 pg/ml). Serum T4 values varied from 0.19-4.09 ng/dl, the mean being 1.039 (normal range 0.70-1.48 ng/dl). The TSH values in our study ranged from 0.01-30.13micro IU/ml, the mean value being 4.69.

In our study 65 patients had thyroid dysfunction of which 56.92% patients had low T3 syndrome, 9.23% had isolated low T4, 18.46% had subclinical hypothyroidism, 13.84% had overt hypothyroidism and 1.53% had hyperthyroidism (Figure 1).

Hypothyroidism was present in 18.18% of stage 4 and 22.35% of stage 5 CKD patients. According to this study number of patients with low T3 and T4 increases with increase in the severity of CKD (Figure 2).

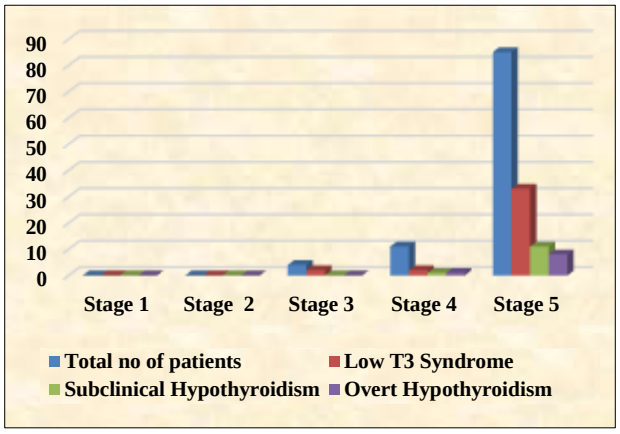

Figure 2: Distribution of thyroid dysfunction in different stages of CKD.

In this study it was found that GFR is positively correlated with serum T3 and T4 level (i.e. with decreasing renal function both T3 and T4 levels decreased). The Pearson‘s correlation coefficient .395 and .321 with significance of .0001 and .001 respectively in the study group of 100 patients ($p<0.05$)

Serum creatinine levels were negatively correlated with serum T3 and T4 level. The Pearson’s correlation coefficients were -254 and -.280 with significance of .01 and .005 respectively in the study group of 100 patients ($p<0.05$).

Blood urea levels were positively correlated with TSH and negatively correlated with T3. The Pearson’s coefficients were -293 and -.223 with significance of .003 and .026 respectively in study group of 100 patients. ($p<0.05$)

DISCUSSION

In this study 100 patients of CKD were studied, among these 81 were males and 19 were females, their age varied from 27-77 years (mean 50.62±13.62). Among these 100 patients, patients who were below 30 years old

were 7, between 31 - 60 years were 69 and above 60 years of age were 6 in number.

Of the 100 patients, 85 had GFR of less than 15 ml/minute accounting for 85%, 11 patients had GFR ranging from 15-29 ml/minute accounting for 11% and 4 patients had GFR ranging from more than 30 ml/minute accounting for 4% of cases and the glomerular filtration rate varied from 2-47 ml/min/1.73m^2.

The blood urea value varied from 58-312 mg/dl, the mean value being 177.83 mg/dl. Among the patients studied most of them had blood urea in the range of 100-200 mg/dl. The creatinine values varied from 1.8-19.2 mg/dl, the mean value being 8.28mg/dl. Among the patients studied most of them had serum creatinine in the range of 4-12 mg/dl.

Serum vitamin D values were found to be low in 85% patients, normal in 15% patients. 9 patient had vitamin D level below 10 ng/ml, 33 between 10-20 ng/ml and 58 patients had vitamin D above 20 ng/ml. Mean vitamin D level was 21.03 ng/ml

Serum PTH values were found to be high in all 100 patients. 47% patients had PTH level below 400 pg/ml, 48% had between 400-800 pg/ml and 5% patients had above 800 pg/ml.

In this study, ultrasound abdomen was done in all patients, that showed features of contracted kidney in 88 patients accounting for 88% and the remaining 12 patients had loss of cortico-medullary differentiation which accounts for 12%. Out of 100 patients in this study, 82 patients had anaemia.

In this study out of 100 patients, 37% patients had low T3 syndrome, in which 3 (8.1%) patients were below 30 years of age, 28 (75.67%) patients were between 30-69 years and 6 (16.21%) were above 60 years of age. Among low T3 syndrome M: F ratio was 3.11:1. T3 value varied from <1.00 to 9.22 pg/ml and the mean value being 1.86.

Similar to this study several studies reported in CKD patients showed low T3 values. Low T3 had been reported by Ramirez et al, Hegedus et al, Beckett et al, Singh et al, Iglesias et al and many others.[3-7] Ramirez and Spector et al study showed linear correlation between mean serum T3 and T4 and severity of renal failure which was similar to this study.[3,8]

The TSH values in our study ranged from 0.01-30.13 micro IU/ml, the mean value being 4.69. Among 100 patients, 78 patients were in the normal range, I patients had low TSH value and 21 patients had high value of more than 4.94 micro IU/ ml. In patients who were in the high range, majority 13 patients were in the age group of 30-60 years, while 7 patients were in the age group of more than 60 years and 1 patient below 30 years of age group. In our study TSH levels were directly associated to urea but not ass with serum creatinine and GFR. Unlike this study Lo, et al had found that frequency of hypothyroidism was increasing with decrease in GFR.[9]

In this study out of 100 patients 21% had hypothyroidism, in which 57.14% had subclinical hypothyroidism and remaining 42.85% had overt hypothyroidism. Among 12 patients of subclinical hypothyroidism, 11 patients belonged to stage 5 CKD and remaining to stage 4 CKD. 7 patients of subclinical hypothyroidism were in age group of 30-60 year, 4 were in above 60 years and 1 below 30 years of age group. Among 9 patients of overt hypothyroidism, 8 patients belonged to stage 5 CKD and remaining to stage 4 CKD. 6 patients of overt hypothyroidism were in the age group of 30-60 years and remaining 3 in above 60 years of age group.

Previous studies by Quionverdeet, et a1 reported high preponderance of hypothyroidism in CKD.[10] It was estimated to be about 5% in patients with terminal stage of renal failure. In this study incidence of subclinical hypothyroidism was 12% and that of overt hypothyroidism was 9%.

Elaborated study by Kaptein, et al estimated the prevalence of primary hypothyroidism was about 2.5 times much frequent in chronic kidney disease and dialysis patients.[11,12] The hypothyroidism in CKD was estimated to range between 0 and 9.5% but does not correlate with the severity of the renal failure, which is similar to our study.

Ramirez et al showed high preponderance of goitre in patients with CKD especially those on chronic dialysis. The incidence was found to be increased in end stage renal disease.[3] The possible explanation is due to accumulation of iodides in Thyroid gland due to decreased renal clearance in CKD patients. Apart from goitre, study reported by Hegedus, et al showed thyroid gland volume was significantly increased in patients with CKD.[13] In this study, one hypothyroid patient had goitre. Haemodialysis and continuous ambulatory peritoneal dialysis have shown to affect the thyroid profile independently of CKD.

Also, drugs like heparin, furosemide used during dialysis will affect the thyroid profile. Kayima, et a1 and Giordano, et al have showed 90 studies regarding effect of dialysis on CKD patients with thyroid dysfunction.[5,14] These studies showed no significant improvement in thyroid profile after repeated haemodialysis. But in the patients who had undergone renal transplant surgery, most of the thyroid function parameters returned to normal with TSH below normal. In this study we found that among the patients being treated with haemodialysis thyroid dysfunction was present in 82.14% compared to 48.61% among those treated conservatively. This result is similar to the study conducted by Lukinac et al.[15]

CONCLUSION

From this study it was established that CKD is associated with thyroid dysfunction characterized by low serum fT3 and fT4 with high TSH in some cases. Low T3 syndrome and subclinical hypothyroidism were the most common thyroid disorders present in CKD patients. Further studies should be conducted to determine the benefits of levothyroxine supplementation among CKD patients with hypothyroidism.

ACKNOWLEDGEMENTS

Authors would like to sincerely thank everyone who has been instrumental in making it a possible. Words fail to express my deep sense of gratitude towards my guide Prof Dr. Umesh Prasad (DTMH, MD General Medicine) for his unfailing belief in me. Authors have been blessed to work under his guidance and learnt lots of things from him. He encouraged and guided us from the inception of this project in 2018 till the very end. Last but not the least Authors would thank all the patients of the study who served as the backbone and without their support the study would have been possible.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not Required

REFERENCES

1. Levey AS, Coresh J, Balk E, Kausz AT, Perrone RD. National kidney foundation practice guidelines for chronic kidney disease: evaluation, classification and stratifiction. MD Ann Intern Med. 2003;139:137-47.
2. Bargman JM, Korecki KS. Chronic kidney disease. In: Dan L. Lango, Anthony S. Fauci, Dennis Kasper et al. Harrison's Principles of Internal Medicine, Vol. 2, 18th edn., McGraw Hill, USA; 2011:2289-93;2308-13.
3. Ramirez G, Jubiz W, Gutch CF, Bloomer HA, Siegler R, Kolff WJ. Thyroid abnormalities in renal failure: A study of 53 patients on chronic hemodialysis. Ann Intern Med. 1973;79:500-4.
4. Hegedus L. Thyroid gland volume and serum concentrations of thyroid hormone in chronic renal failure. Nephron. 1985;171-4.
5. Giordano C. Thyroid Status and nephron loss-a study in patients with chronic renal faialure, end stage renal disease and/or on hemodialysis. Mt J Artif Organs. 1984;17:119-22.
6. Singh PA, Bobby Z, Selvaraj N, Vinayagamoorthi R. An evaluation of thyroid hormone status and oxidative stress in undialyzed chronic renal failure patients. Indian J Physiol Pharmacol. 2006;50:279-84.
7. Iglesias P, Di´Ez JJ. Thyroid dysfunction and kidney disease. Eur J Endocrino. 2009;160:503-15.
8. Spector DA, Davis PJ, Helderman JH, Bell B, Utiger RD. Thyroid function and metabolic state in chronic renal failure. Ann Intern Med.1976;85:724-30.
9. Lo JC, Chertow GM, Go AS, Hsu CY. Increased prevalence of subclinical and clinical hypothyroidism in persons with chronic kidney disease. Kidney Int. 2005;67:1047-52.
10. Quion-verde. Prevalence of thyroid disease in chronic renal failure and dialysis patients. IXt1' mt Congr of Nephrol. 1984;120.
11. Kaptein EM. Thyroid function in renal failure. Contribut Nephrol. 1986;50:64-72.
12. Kaptein E. The Thyroid in end stage renal diseases. Med. 1988;187-97.
13. Hegedus L. Thyroid gland volume and serum concentrations of thyroid hormone in chronic renal failure. Nephron. 1985;171-4.
14. Kayima JK. Thyroid hormones profile in patients with chronic renal failure on conservative management and regular hemodialysis. East Afr Med J. 1992;69:333-6.
15. Lukinac L, Kusić Z, Kes P, Nöthig-Hus D. Effect of chronic hemodialysis on thyroid function tests in patients with end-stage renal disease. Acta Med Croatica. 1996;50(2):65-8.

Cite this article as: Jha DK, Minj G, Prasad U, Lahre Y, Bodra D. Occurrence of subclinical and overt hypothyroidism among chronic kidney disease patients. Int J Res Med Sci 2020;8:3284-7