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Original Research Article

Comparative Evaluation of Serum Thyroid Profile in between Different Stages of Chronic Renal Failure

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Conflict of interest: Nil

Abstract:

Objective: This study aimed to evaluate the Serum Thyroid Profile in between different stages of Chronic Renal Failure

Materials and Methods: 70 patients aged 18-60 years who were diagnosed as Chronic Kidney Disease on the basis of e-GFR and 70 healthy individuals as controls. Overnight fasting venous blood samples were collected from both groups for Thyroid Profile estimation. Urea and Creatinine estimation were also done to test for renal function.

Results: Our study advances our knowledge thyroid hormone in CRF that these patients have decreased serum T3 and serum T4 & increased serum TSH levels compared to different stages of CRF.

Conclusion: Alterations in thyroid hormone may underline many of the aspects of path-physiology and clinical characteristics of CRF. It is worthwhile to check thyroid hormone and T3, T4 and TSH values frequently in CRF patients during the course of the treatment and to treat them accordingly which will result in decreased morbidity and mortality.

Keywords: Chronic Renal Failure, Thyroid Hormones, Hypothalamus Pituitary Glands, Glomerular Filtration Rate.

Introduction

Chronic renal failure is define as also kidney injure or a reduced GFR < 60 ml /min / 1.73 m2 for 3 or additional months [1]. The causes of the chronic kidney failure may be due to primary and secondary glomerular illness, tubulo-interstitial illness and vascular illness (2).The overall prevalence of chronic kidney disease in India is 17.2% and prevalence of chronic renal failure stages 1, 2, 3, 4 and 5 are 7%, 4.3%, 4.3%, 0.8% and 0.8%, correspondingly [3].

The renal play very important role within the metabolism, poverty, and secretion many thyroid hormones, Hence the injury inside renal role in upset thyroid function physiologically; all levels of the hypothalami-pituitary-thyroid axis could be mixed up, together with alteration into hormone manufacture, circulation, and secretion. Epidemiological information to pre-dialysis patients by chronic renal illness have associate exaggerate risk of hypothyroidism [4,5]. Thyroid function are widely evaluated within the chronic renal failure patient, but result obtained be changeable, raise incidence of goiter in those patients has been reported in studies conducted in China and Turkey, whereas other centers such as U. S., Canada, Great Britain and Australia are found to be reverse [6-8]. Primary hyperthyroidism is very uncommon, whereas the incidence of hypothyroidism is raised in patients with chronic renal failure [9-11]. Some manifestations of hypothyroidism like skin colour, physiological condition and illness may also occur in uremia, the exclusion finding of hypothyroidism on clinical basis could be also very difficult, it is based on biochemical tests [12].

A large amount of studies in thyroid hormones within clinically non-thyroid patients changeable grade of chronic kidney disorder has been establish toward decrease in T3 and T4 levels is obvious when Glomerular Filtration Rate (GFR) is less than 30±16 ml/min [13]. Sometimes there's more inhibition of T3 than of T4 [14]. The

concentrations of reverse T3 (rT3), the inactive substance of T4 in plasma are usually low but normal or maybe elevated values are reportable by few authors [15,16]. Serum T3 in transplant patients appears to be greater than control group found in few series [17].

Thyroid binding globulin (TBG) concentration are usually normal in haemodialysis patients and low or normal in patients undergo continuous "dialysis [18,19]. TBG level increased significantly behind renal transplantation [20]. Studies of thyroid hormone kinetics have found to be normal production of endocrine; metabolic clearance rates of the hormone may or may not be enlarged in patients lead to chronic renal failure [21-24]. Peripheral de-iodination of T4 to T3 is impaired [25], this finding is according" to more obvious decrease of T3 than of T4 in progressive renal failure, and as a replacement for beneficial diversion to inactive metabolites [24].

The different between thyroid and non – thyroid subjects, T3 production and metabolic "clearance rate are usual, and there's increase additional vascular binding of the hormone, leading to low or normal values [26]. A lot of the studies confirmed that pituitary-thyroid axis of thyroid hormone have found to be irregular in uremic patients depending on the study of the normal TSH concentration even with low T3 and T4 [27], as well as abnormal response of TSH following direction of exogenous thyrotrophin releasing hormone [28- 30].

Chronic renal disorder (CRD) affects thyroid function in multiple ways in which, as well as low circulating thyroid hormone concentration, changed peripheral hormone metabolism, troubled binding to carrier proteins, possible reduction in tissue thyroid hormone substance", as well as additional amount of iodine stoke in thyroid glands [31].

To target of study is to found a connection between different stages of chronic renal failure (on the basis of eGFR) with thyroid function.

Materials and Methods:

This study was carried out from 1st January 2018 to 31st December2018 aged 18 to 60 years was selected from the medicine OPD & IPD at Teerthanker Mahaveer Hospital & Research Centre, Moradabad. Comparison of patients of chronic renal failure on the basis of e-GFR. Informed consent was taken from each subject before collecting the blood sample. Patients with age more than 18 years and less than 60 years and diagnosed as chronic renal failure was included in the study. Patients with Acute renal failure, Cancer and diagnosed with thyroid disorder (Goiter, Graves disease, Hashimoto's thyroiditis) was excluded. Early morning 5ml venous blood sample was collected for different biochemical tests- serum T3, T4, TSH, serum Creatinine, serum urea and serum uric acid. Serum total T3, T4, TSH for thyroid confirmation was estimated by enzyme immunoassay competition method with ELFA technique (Enzyme linked fluorescent assay) by using fully automated VIDAS®.. Serum Creatinine was estimated by Jaffe's method, serum urea by Urease method and serum uric acid by Uricase method by using Erba. Estimation of eGFR by using Cockcroft – Gault equation eGFR(ml/min) = [140- age(years)× weight (kilogram) / 72 × serum creatinine (mg%) (×0.85 if female)

Statistical Analysis: Statistical analyses were carried out by using SPSS 16. Mean ± SD were measure for each parameter analysed with compared via student's t-test with linked by calculating Pearson's correlation coefficient. P value less than 0.05 is Significant and P value less than 0.001 is highly significant.

Results

A total of 70 cases 48 were male's individuals and rest 22 was female's individuals and in controls, 40 was male's individuals and rest 40 was females individuals.

In Table No. 1, Mean level of serum creatinine (5.22±3.70 mg/dL), Serum Urea (106.11±43.76 mg/dL) and Serum uric acid (8.45±2.74 mg/dL), of CRF patient's shows statistical significant difference as compared with the mean of serum creatinine (0.78±0.18 mg/dL), Serum Urea (32.11±9.44) and Serum Uric acid (4.69±1.12 mg/dL) in controls.

In Table No. 2, Mean level of Serum T3 (0.67±0.13 ng/mL), Serum T4 (6.07±1.76µg/dL) and Serum TSH (5.38±1.79µIU/dL), of cases shows Statisticall significant difference as compared with the mean of Serum T3 (1.06±0.34 ng/mL), Serum T4 (7.71±1.46µg/dL) and Serum TSH (2.24±1.46 µIU/mL) in controls.

Table 1: Comparison of kidney function parameters in between CRF patients and controls

Sr.no	Biochemical parameters	Control mean±S.D	CRF Patients mean±S.D	p-value
1	Serum Creatinine(mg/dL)	0.78±0.18	5.22±3.70	0.000
2	Serum Urea(mg/dL)	32.11±9.44	106.41±43.76	0.000
3	Serum Uric acid(mg/dL)	4.69±1.12	8.45±2.74	0.000

Table 2: Comparison of Serum T3, Serum T4 and Serum TSH between CRF patients and controls

Sr.no	Biochemical parameters	Controls mean±S.D	CRF Patients mean±S.D	p-value
1	Serum T3(ng/ml)	1.06±0.34	0.67±0.13	0.000
2	Serum T4(µg/dl)	7.71±1.46	6.07±1.76	0.000
3	Serum TSH(µIU/ml)	2.24±1.46	5.38±1.79	0.000

Table 3: Comparison of Serum T3, Serum T4 and Serum TSH between different stages of chronic renal failure

Sr.no	Biochemical parameter	Stage 3 mean±S.D	Stage 4 mean±S.D	Stage 5 mean±S.D
1	Serum T3 (ng/ml)	0.68±0.13	0.70±0.12	0.65±0.13
2	Serum T4(µg/dl)	8.15±0.93	6.08±0.87	4.69±1.17
3	Serum TSH(µIU/ml)	4.44±1.61	5.28±0.86	6.08±2.09

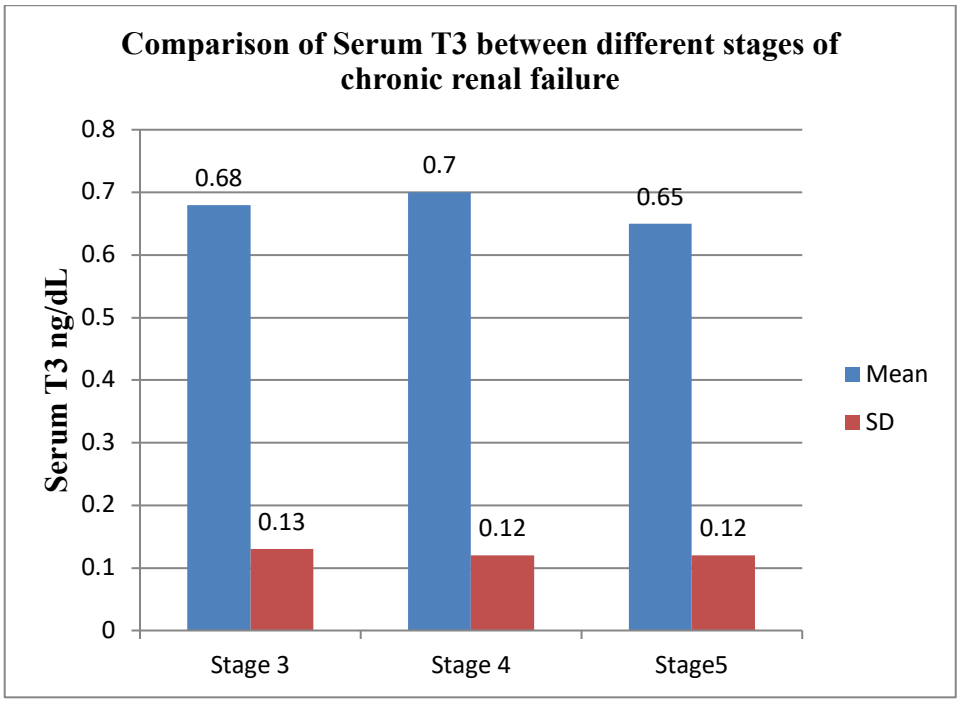

Figure 1: Comparison of Serum T3 between different stages of chronic renal failure

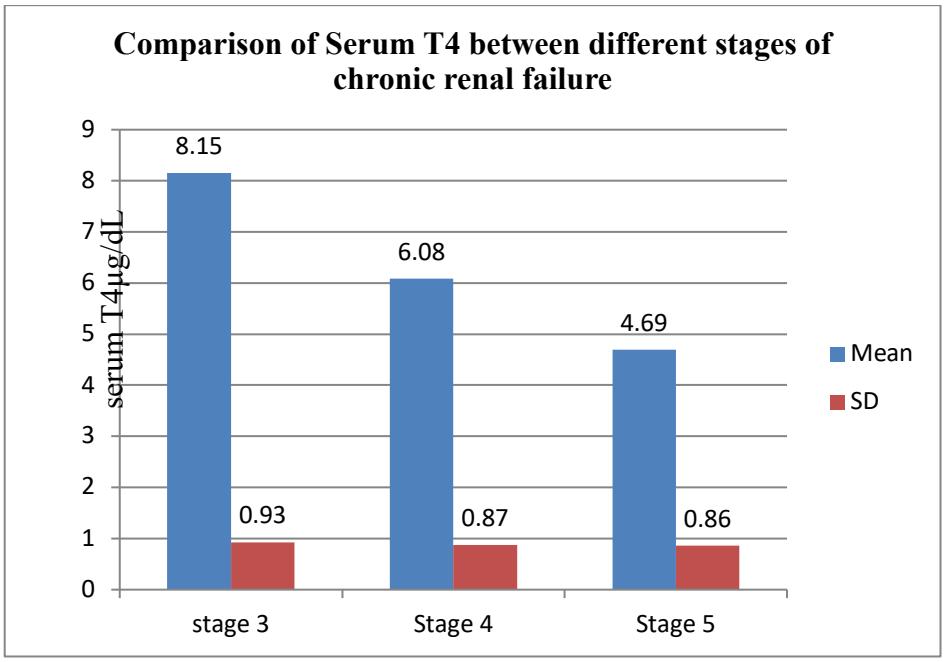

Figure 2: Comparison of Serum T4 between different stages of chronic renal failure

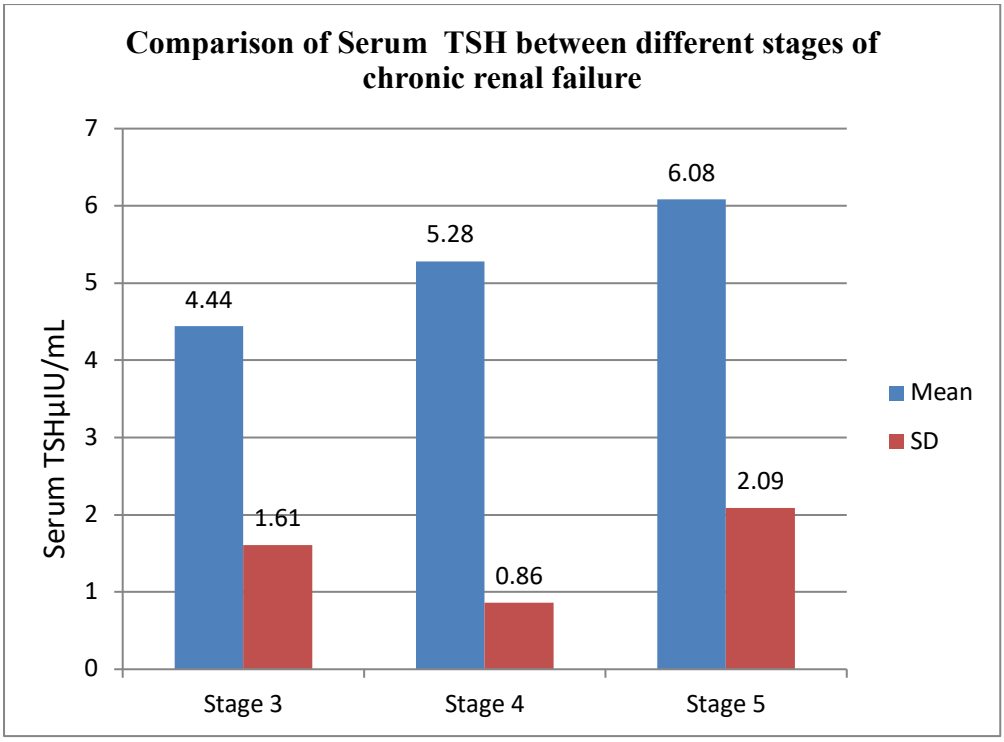

Figure 3: Comparison of Serum TSH between different stages of chronic renal failure

Discussion

The study population was divided into different stages of CRF according to eGFR. Patients with eGFR between 31-45 ml/min were put in stage 3. In stage 3 the levels of serum T3 and serum T4 were less as compared to controls, whereas the level of serum TSH was slightly more as compared to controls. Those with eGFR between the 15-29ml/min lie in stage 4. The thyroid profile in Stage 4 showed Variation as compared to stage 3. There was further decline in value of serum T3 and serum T4 value as compared to Stage 3whereas there was further increase in serum TSH. In last stage of renal disease the e GFR is less than 15ml/min. In this stage the T3 and T4 levels are further decreased as compared to Stage 4 whereas the levels of TSH values were highly increased.

In stage 3 of CRF the eGFR becomes less than 45ml/min. In this stage we observed that the mean value of T3 was 0.68±0.13ng/ml which was less than control. In stage 4 due to further decline in kidney function the value of serum T3 decreases. The mean value of T3 in this stage was 0.70±0.12ng/ml. In ESRD very less number of nephrons is functional therefore value further decreases to 0.65±0.13ng/ml in Stage 5. The mean difference of serum T3 level is -0.03 ng/ml between stage 3and stage 5, the value of which changes to -0.05 ng/ml between stage 4 and stage 5, whereas it is 0.02 ng/ml between stage 3 and stage 4. The above mentioned mean differences were not statistically significant. In stage 3 of CRF the eGFR becomes less than 45ml/min. In this stage we observed that the mean value of T4 was 8.15±0.93µg/dl which was less than control. In stage 4 due to further decline in kidney function the value of serum T4 decreases. The mean value of serum T4 in this stage was 6.08±0.87µg/dl. In End stage renal disease very less number of nephrons is functional therefore value further decreases to4.69±1.17µg/dl in Stage 5. We observed mean difference of serum T4 level was -3.46 µg/dl between stage 3and stages 5, it was -1.39µg/dl between stage 4 and stage 5, whereas the serum T4 level was -2.06 µg/dl between stage 3 and stage 4. The above mentioned mean differences were statically significant between stage 3 & stage 5,stage 4 & stage 5 and stage 3 & stage 5.

In stage 3 of CRF the eGFR becomes less than 45ml/min. In this stage we observed that the mean value of TSH was 4.44±1.61µIU/ml which was less than control. In stage 4 due to further decline in kidney function the value of serum T4 decreases. The mean value of serum TSH in this stage was 5.28±0.86µIU/ml. In End stage renal disease very less number of nephrons are functional therefore value further decreases to 5.28±0.86µIU/ml in Stage 5. The mean difference serum TSH level was 1.63 µIU/ml between stage 3and stages 5. The above mentioned mean differences were statically significant between stage and stage 5.

Song et al; hypothesized that the popularity of decrease T3 syndrome would be raised according to the higher of CRF stages. There was a raised tendency form the people of reduce T3 according to the raised of CRF stage. This study showed that

reduced T3 syndrome was very common in CRF and was a significant finding in near the beginning of CRF. Also, serum T3 value was related with cruelty of CRF in normal thyroid stimulating hormone value.

Conclusion

Our study advances our knowledge thyroid hormone in CRF that these patients have decreased serum T3 and serum T4 & increased serum TSH levels compared to different stages of CRF. These alterations in thyroid hormone may underline many of the aspects of pathophysiology and clinical characteristics of CRF. Furthermore significant correlations were found between increased serum TSH level with serum creatinine and urea. While no correlated could be seen between reduced serum T3, T4 and serum creatinine, urea and uric acid. It is worthwhile to check thyroid hormone and T3, T4 and TSH values frequently in CRF patients during the course of the treatment and to treat them accordingly which will result in decreased morbidity and mortality. Hence it is recommended that strict monitoring of thyroid hormone in CRF patient be done as early detection and treatment of these abnormalities will enhance the quality of life and improve prognosis in such patients.

Ethical Consideration: The study was approved by Teerthankar Mahaveer University Non-Invasive Research Ethics Committee.

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References:

1. Levey As, Coresh J and Bake E.:National kidney foundation practice guidelines for chronic kidney disease: evaluation, classification, and stratification, Ann Intern Med., 2003; 139(2): 137-14.
2. Chobanian AV, Bakris GL, Black HR, Cushman WC: Green LA and Izzo JL:The seventh report of the joint national committee on prevention, detection, evaluation and treatment of high blood pressure, JAMA, 2003; 289(19): 2560 – 2572.
3. Ajay K Singh et al. Epidemiology and risk factors of chronic kidney disease in India – results from the SEEK (Screening and Early Evaluation of Kidney Disease) study, BMC Nephrology. 2013.14:114.
4. Lo JC, Chertow GM, Go AS, and Hsu CY. Increased prevalence of subclinical and clinical hypothyroidism in persons with chronic kidney disease. Kidney Int, 2005 Mar; 67(3): 1047-52.
5. Chonchol M, Lippi G, Salvagno G, Zoppini G, Muggeo M, Targher G. Prevalence of sub clinical hypothyroidism in patients with chronic kidney disease. Clin J Am Soc Nephrol, 2008 Sep; 3(5): 1296- 300.
6. Lin CC, Chen TW, Ng YY, Chou YH, and Yang WC. Thyroid dysfunction and nodular goiter in hemodialysis and peritoneal dialysis patients. Perit Dial Intl, 1998; 18(5): 516-521.
7. Kutlay S, Atli T, Koseogullari O, Nergizoglu G, Duman N, and Gullu S. Thyroid disorder in hemodialysis patients in an iodine deficient community. Artif Org, 2005; 29(4): 329-332.
8. Silverberg DS, Ulan RA, Fawcett DM, Dossiers JB, Grace M, Bettcher K. Effect of chronic hemodialysis on thyroid function in chronic renal failure. Can Med Assoc J, 1973 Aug 18; 109(4): 282-6.
9. Gomez-pan A, Alvarez-ude F, Yeo PB, Hall R, Evered DC, Kerr DN. Function of the hypothalamic- hypophyseal-thyroid axis in chronic renal failure. Clin Endocrinol, 1996; 2: 567-574.
10. Kaptein EM, Quion-Verde H, Chooljian CJ, Tang WW, Friedman PE, Rodriquez HJ, et al. The thyroid in end stage renal disease. Medicine (Baltimore), 1988 May; 67(3): 187-97.
11. Shirota T, Shinoda T, Aizawa T, Mizukami T, Katakura M, Takasu N, etal.Primary hypothyroidism and multiple endocrine failures in association with hemochromatosis in a long term hemodialysis patients. Clin Nephrol, 1992 Aug; 38(2): 105-9.
12. Schaefer F, Anderzej W, Eberhard R. The patient with failing renal function,endocrine disorders. In: Davidson Alex M, Cameron J Stewart, Rit, Eberhard, David N, Krr S, Graunfeld Jean-pierre, Oxford Textbook of Clinical Nephrology, Oxford University Press, 1997; 3187-3194.
13. 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 Sep; 16(9): 2789-95.
14. Zoccali C, Mallamaci F, Tripepi G, Cutrupi S, Pizzini P. Low triiodothyronine and survival in end-stage renal disease. Kidney Int, 2006 Aug; 70(3): 523-8.
15. Kosowicz J, Malczewska B, and Czekaleski S. Serum reverse triiodothyronine (3, 3, 5-L-triiodothyronin) in chronic renal failure. Nephron, 1980; 26(2): 85- 90.
16. Vaziri ND, Gwinup G, Martin D, Seitzer J. Thyroid function in chronic renaL failure after successful renal transplant. Clin Nephrol, 1981; 15(3): 131-134.
17. Pagliacci MC, Pelicci G, Grignani F, Giammartino C, Fedeli L, Carobi C, et al.Thyroid function tests in patients undergoing maintenance dialysis: characterization of the “low T4 syndrome” in subject on regular hemodialysis

and continuouse ambulatory peritoneal dialysis. Nephron, 1987; 46(3): 225-30.
18. Robey C, Shreedhar K, and Batuman V. Effect of chronic peritoneal dialysis on thyroid function tests. Am J Kid Dis, 1993; 13: 99-103.
19. Lambert M, De Nayer P, Ghysen J, Cornette C, Beckers C, and Vanpersel C. Decreased serum TBG concentration in the face of normal T4-binding capacity in patients on hemodialysis. Clin Nephrol, 1989; 32(3):129-32.
20. Kaptein EM, Kaptein JS, Chang EI, Egodage PM, Nicoloff JT, and Massry SG. Thyroxine transfer and distribution in critical nonthyroidal illnesses, chronic renal failure, and chronic ethanol abuse. J Clin Endocrinol Metab, 1987; 65:606-616.
21. Liewendahl K, Tikanoja S, Mahonen H, Helenius T, Valimaki M, and Taligren LG. Concentration iodothyronines in serum of patient with chronic renal failure and other nonthyroidal illnesses: role of free fatty acid. Clin Chem, 1987; 33: 1382-1386.
22. Hardy MJ, Ragbeer S, and Nascimento L. Pituitary- thyroid function in chronic renal failure assessed by highly sensitive thyrotropin assay. J Clin Endocrinol Metab, 1988; 66: 233-236.
23. Faber J, Heaf J, Kirkegaard C, Lumholtz IB, Siersbaek- Nielsen K, Kølendorf K, et al. Simultaneous turnover studies of thyroxine, 3,5,3' and 3,3',5' triiodothyronine, 3,5-, 3,3'-, and 3',5'-diiodothyronine, and 3' monoiodothyronine in chronic renal failure. J Clin Endocrinol Metab, 1983 Feb; 56(2): 211-7.
24. Lim VS, Fang VS, Katz AI, and Refetoff S. Thyroid dysfunction in chronic renal failure. J Clin Invest, 1977; 60: 522-534.
25. Kaptein EM, Feinstein EI, Nicoloff JT, and Massry SG. Serum reverses triiodothyronine and thyroxine Kinetics in patients with chronic renal failure. J Clin Endocrinol Metab, 1983; 57: 181-189.
26. Ross RJ, Goodwin FJ, Houghton BJ, and Boucher BJ. Alteration of pituitary-thyroid function in patients with chronic renal failure treated by haemodialysis or continuous ambulatory peritoneal dialysis. Ann Clin Biochem, 1985; 22 (pt2): 156-160.
27. Rao MB, Bay WH, George JM, and Herbet LA. Primary hypothyroidism in chronic renal failure. Clin Nephrol, 1986; 25: 11-14.
28. Giordano C, De Santo NG, Carella C, Mioli V, Bazzato G, Amato G, et al. TSH response to TRH in hemodialysis and CAPD in patients. Int J Artif Organs, 1984 Jan; 7(1): 7-10.
29. Duntas L, Wolf CF, Keck FS, Rosenthal J. Tyrotpopin- releasing hormones: pharmacokinetic and pharmacodynamic properties in chronic renal failure. Clin Nephrol, 1992; 38: 214-218.
30. Ali K Layla et al. The effect of chronic renal failure on thyroid hormones vol.19 (1)2010-65. 10.
31. Harrison's principles of Internal Medicine. 18th edition, chapter 280, Chronic Kidney Disease. 1289-94. 2.