IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 9 Ser.10 (September. 2019), PP 61-64www.iosrjournals.org

Thyroid Function Abnormalities in Patients with End-Stage Renal Disease Undergoing Hemodialyis

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Abstract

Background: *The kidney plays a vital role in the metabolism,degradation and excretion of thyroid hormones. Patients with End-stage renal disease (ESRD) have thyroid dysfunction due to severe renal failure and effects of hemodialysis. This study was designed to detect thyroid function abnormalities in patients with ESRD undergoing hemodialysis.*

Material and Methods: *This was a hospital based cross sectional observational study conducted at Universal College of Medical Sciences and Teaching Hospital, Bhairahawa,Nepal from 1st February 2019 to 31st July 2019. A total of 99 ESRD patients were enrolled after applying inclusion and exclusion criteria.*

Results: *Out of 99 ESRD patients, 71.72% were males and 28.28% females.Low fT3 levels was the most common thyroid dysfunction seen in 28 patients (28.28%). Thirteen patients (14.44%) had low fT4, 20(20.20%) had high TSH and 4 (4.44%) had low TSH levels. Overt hypothyroidism was observed in 4(4.04%) patients and subclinical hypothyroidism were found in 10 patients.*

Conclusion: *ESRD leads to significant changes in level of thyroid hormones due to renal failure and effects of hemodialysis which need to be interpreted carefully. Early diagnosis and treatment of hypothyroidism may improve the quality of life of ESRD patients.*

Keywords: *End-stage Renal Disease; Hemodialysis; Thyroid dysfunction; Subclinical Hypothyroidism*

Date of Submission:07-09-2019 Date of Acceptance: 23-09-2019

I. Background

End-stage renal disease (ESRD) is the late stage 5 Chronic Kidney Disease (CKD) managed with renal replacement therapy.[1,2] There is a vital role of kidney in the metabolism, degradation and excretion of thyroid hormones. CKD disrupts functions of thyroid in different ways including decrease thyroid hormone concentration in the circulation, decrease protein binding and upsets storage of iodine in the thyroid gland. There is also disturbance in hypothalamus-pituitary-thyroid axis in CKD. So, in CKD there is alteration of thyroid hormones.[3] In euthyroid patients with ESRD, there may be reduced total and free tri-iodothyronine (fT3) and free thyroxine (fT4) levels.[4] Low fT3 in uremia is also due to diminish peripheral conversion of T4 to T3.[5]Binding of T4 to thyroid binding globulin is also disturbed by the heparin and free fatty-acids in the blood.[6] There is occurrence of Malnutrition-Inflammation Syndrome in patients undergoing hemodialysis which may lead to low levels of T3.[7]

The data regarding thyroid hormone abnormalities in ESRD in Nepal is limited. This study was carried out to detect the thyroid hormone abnormalities among the patients of ESRD undergoing hemodialysis in our settings.

II. Materials and methods

This was a cross-sectional observational study conducted in the Department of Internal Medicine, Universal College of Medical Sciences, BhairahawaNepal between 1st February 2019 to 31st July 2019. The study protocol was approved by the Institutional Review Committee and informed consent was taken from all the participants. A total of 99 patients aged more than 16 years and fulfilling the criteria for ESRD undergoing hemodialysis were enrolled in the study. Patients unwilling to give consent as well as with thyroid disorders before being diagnosed as ESRD, taking medications for thyroid dysfunction or taking drugs altering thyroid hormones, pregnancy, nephrotic range of proteinuria and other acute medical illness were excluded in this study.

After cleaning skin with rectified spirit, about 5ml blood was collected by nurses from ESRD patients on hemodialysis. The analysis of blood for serum urea, creatinine, glucose, T3, T4 and thyroid stimulating hormone (TSH) were done. Serum fT3, fT4 and TSH were measured by Maglumi 2000, Snibe diagnostic which was chemiluminiscence immunoassay technique (CLIA). Serum creatinine was measured by using Humastar 600 fully automated biochemistry analyser, Germany. Thyroid hormone abnormalities were made if patients thyroid hormones were outside the normal values; fT3 (2.0-4.2 pg/ml), fT4 (8.9-17.2 pg/ml) and TSH (0.3-4.5 mIU/ml).

Statistical analysis was done using SPSS version 20.0 software. Categorical data were presented as frequencies and corresponding percentages. Quantitative data were presented in mean± SD. The level of significance for all analytical test were set at 0.05 and 'p-value $\leq$ 0.05 was considered significant.

III. Results

Ninety-nine patients with ESRD on maintenance hemodialysis were enrolled in this study. Among those patients, 71 (71.72%) were male and 28 (28.28%) female. The mean age of patients was 50.73 years with minimum 22 years and maximum87 years. Among 99 patients, 22 patients were in the age group of 16-40 years, 60 were in age group of 41-60 years and 7 above 60 years. The mean duration of dialysis was 11.79 months with minimum 1 month and maximum of 5.5 years. The glomerular filtration rate (GFR) varies from 1.5 to 14.83 ml/min with mean of 7.47 ml/min among those ESRD patients. The minimum blood urea was 50 mg/dl and maximum 316 mg/dl with mean 146.3 mg/dl. Serum creatinine varied from 2.8 to 23.2 mg/dl with mean 9.8 mg/dl. The mean value of fT3 was 2.52 pg/ml with minimum of 1.3 and maximum 4.1pg/ml. The low level of fT3 was seen in 28 patients out of which 21 patients were male and 7 female. It is seen that 13 patients with low level of fT3 were from age group of 41-60 years, 8 patients in 16-40 years and 7 patients above 60 years.Among 99 patients, 13 patients had low fT4 level, 6 patients in the age group of 41-60 years, 4 patients in the age group of 16-40 and 3 patients were above 60 years. Out of 13 patients with low fT4, 9 were male and 4 female. The low level of both fT3 and fT4 was seen in 11 patients. Serum TSH level was altered in 24 patients. Among 24 patients 20 had high level of TSH and 4 had low level of TSH. None of the patients in our study had fT3 and fT4 value above normal level. There is weak positive correlation (r=0.103) between TSH and GFRand it is not-statistically significant (p=0.302).

Table 1: Clinical parameters of patients

	Age(yrs)	duration of dialysis (months)	Urea (mg/dl)	Creatinine (mg/dl)	GFR (ml/min)	fT3(pg/ml)	fT4(pg/ml)	TSH (miU/ml)
Mean	50.73	11.79	146.3	9.87	7.47	2.52	11.49	3.67
Standard Deviation	14.261	11.615	66.53	4.13	3.23	0.69	4.67	3.57
Range	65	65	346	20.4	13.33	2.8	16.51	25.66
Minimum	22	1	50	2.8	1.5	1.3	0.8	0.02
Maximum	87	66	396	23.2	14.83	4.1	17.31	25.68

Table 2: Thyroid function test

	Frequency (%)		
Thyroid function	Normal No (%)	High No (%)	Low No (%)
fT3	71(71.7)	0	28(28.3)
fT4	86(86.9)	0	13(13.1)
TSH	75(75.8)	20(20.2)	4(4.0)

Abbreviations:GFR- Glomerular Filtration rate; fT3-tri-iodothyronine; fT4-Thyroxine;
TSH-Thyroid Stimulating Hormone

IV. Discussion

Thepresent study have identified thyroid hormone abnormalities in ESRD patients undergoing hemodialysis. The level of fT3 was lower in 28 patients (28.28%) among 99 studied patients. These findings were seen in various studies conducted earlier by different authors. Low fT3 level had been reported in studies done by Ramirez et. al.[8], Hegedus et. al.[9] and Beckett et. al.[10]. The low level of fT3 is mainly due to diminished peripheral conversion of T4 to T3.[5] There is presence of Malnutrition-Inflammation Syndrome in patients undergoing hemodialysis which may lead to low levels of fT3.[7] Various factors like metabolic acidosis and loss of bound and free T4 in urine also causes low T3 levels.[11]

In present study it is observedthat 13 out of 99 ESRD patients had diminished fT4 level. The major cause of reduction of fT4 level may be due to disturbed T4 binding to serum carrier protein like thyroid hormone binding globulin and to lesser extent prealbumin and albumin.[11] Binding of T4 to thyroid binding globulins is also disturbed by heparin and free-fatty acids in the blood.[6] The diminished fT3 levels in chronic hemodialysis patients had emerged as a potent predictor of morbidity and mortality independently of conventional risk factors.[12]

In present study, 24 patients out of 99 ESRD patients had altered level of serumTSH. Among those patients, 20 had high level of TSH and 4 patients had low level. Overt hypothyroidism was seen in 4 patients(4.04%) and subclinical hypothyroidism was noticed in 10 patients.Quion-Verde et. al.[13]reported little bit higher prevalence of hypothyroidism in CKD patients in their study. It was estimated to be about 5% in patients with CKD. The prevalence of primary hypothyroidism was about 2.5 times most frequent in CKD and patient s onhemodialysis as reported by Kaptein et. al.[14]. In present study, overt hypothyroidism was present in 4.04% and subclinical hypothyroidism was present in 10.10% of patients but this didn't correlate with the severity of renal failure. A study done in hemodialysis patients in Western Nepal showed the combined prevalence of subclinical and clinical hypothyroidism 26.6%.[15]The prevalence of subclinical hypothyroidism was 24.8% in a study done in India among ESRD patients.[16]The prevalence was low in present study due to exclusion of patients with known thyroid disorders before being diagnosed as ESRD, patients taking medications for thyroid dysfunction or taking drugs altering thyroid hormones and other acute medical illness.

Hypothyroidism can worsen CKD patients in various ways like increasing cardiovascular diseases, precipitates myocardial dysfunction, aggravates neurobehaviour and neuromuscular dysfunctions, further decreases hemoglobin level and increases erythropoietin resistance.[17]Recent studies concluded that thyroid hormone replacement in ESRD patients with subclinical hypothyroidism increase the quality of life.[18]

Hence more studies are needed to know the various type of thyroid dysfunction, underlying mechanisms and associations in ESRD patients undergoing hemodialysis in Nepal. The limitation of this study is that the study conducted in one center, so findings of this study cannot be generalized.

V. Conclusion

The present study finds thyroid hormone abnormalities in ESRD patients undergoing hemodialysis. Low fT3 was most common thyroid dysfunction. The present study demonstrates few numbers of subclinical and clinical hypothyroidism among hemodialysis patients.

The clinician should pay attention during interpretation of thyroid function test in ESRD patients undergoing hemodialysisas various dysfunction is seen due to renal failure as well as by effects of hemodialysis. Both clinical and biochemical parameters are essential to diagnose hypothyroidism in ESRD patients. There is worsening of CKD symptoms with coexisting hypothyroidism. Early diagnosis and treatment of hypothyroidism may improve quality of life in these patients.

Competing interests

The authors declare that they have no competing interests.

Funding

Not applicable

References

[1]. Ekart R, Ferjuc A, Furman B, Gerjevic S, Bevc S, HojsR. Chronic kidney disease progression to end stage renal disease: a single center experience of the role of theunderlying kidney disease. TherApher Dial. 2013; 17:363-7.

[2]. Singh PA, Bobby Z, Selvaraj N, Vinayagamoorti R. Anevaluation of thyroid hormone status and oxidative stressinundialyzed chronic renal failure patients. Indian J PhysiolPharmacol. 2006;50(3):279-84.

[3]. Malyszko J, Malyszko J, Wolczynski S, Mysliwiec M. Adiponectin, leptin andthyroid hormones in patients with chronic renal failure and on renalreplacement therapy: are they related? Nephrol Dial Transplant.2006;21(1):145-52.

[4]. Carrero JJ, Qureshi AR, Axelsson J, Yilmaz MI, Rehnmark S, Witt MR, et al. Clinical and biochemical implications of low thyroid hormone levels (total and free forms) in euthyroid patients with chronic kidney disease. *Journal of internal medicine.* 2007;262(6):690-701.

[5]. 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; 67(3):187-97.

[6]. Herschman JM, Jones MC, Bailey AL. Reciprocal changes in serum thyrotropin and free thyroxine produced by heparin. J ClinEndocrinolMetab 1972; 34(3):574-9.

[7]. Zoccali C, Tripepi G, Cutrupi S, Pizzini P, Mallamaci F. Low triiodothyronine: a new facet of inflammation in end-stage renal disease. J Am SocNephrol 2005; 1699):2789-95.

[8]. Ramirez G, O'Neill W Jr, Jubiz W, Bloomer HA. Thyroid dysfunction in uremia: Evidence for thyroid and hypophyseal abnormalities. Ann Intern Med 1976; 84:672-6.

[9]. Hegedüs L, Andersen JR, Poulsen LR, Perrild H, Holm B, Gundtoft E, *et al.* Thyroid gland volume and serum concentrations of thyroid hormones in chronic renal failure. Nephron 1985; 40:171-4.

[10]. Beckett GJ, Henderson CJ, Elwes R, Seth J, Lambie AT. Thyroid status in patients with chronic renal failure. ClinNephrol1983; 19:172-8.

[11]. Padhy S, Devi KA. Evaluation of thyroid hormone status in chronic renal failure. Int J Pharm Bio Sci.2014;5(1):(B)171-5.

[12]. Fragidis S, Sombolos K, Thodis E, Panagoutsos S, MourvatiE, Pikilidou M, et al. Low T3 syndrome and long-termmortality in chronic hemodialysis patients. World J Nephrol. 2015;4(3):415-422.

[13]. Quion-Verde H. Prevalence of thyroid disease in chronic kidney failure and dialysis patients. No. 120. IXthInternational Conference on Nephrology; 1984.

[14]. Kaptein EM. Thyroid function in renal failure. ContribNephrol1986; 50:64-72.

[15]. Paudel K. Prevalence and clinical characteristics of hypothyroidism in apopulation undergoing maintenance hemodialysis. J ClinDiagn Res. 2014;8(4):MC01–4
[16]. Shantha GPS, Kumar AA, Bhise V, Khanna R, Sivagnanam K, Subramanian KK. Prevalence of subclinical hypothyroidism in patients with end-stage renal disease and the role of serum albumin: a cross-sectional study from South India. Cardiorenal Med. 2011;1(4):255–60.
[17]. Fein HG, Rivlin RS. Anemia in thyroid diseases. The Medical clinics of North America. 1975;59(5):1133-45. Epub 1975/09/01.
[18]. Shin DH, Lee MJ, Kim SJ, et al. Preservation of renal function by thyroid hormone replacement therapy in chronic kidney disease patients with subclinical hypothyroidism. J ClinEndocrinolMetab. 2012; 97(8): 2732-40.

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