Role of Chronic Hemodialysis in Thyroid Gland Morphology Disorders

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Thyroid gland morphology is affected in patients with chronic kidney disease. The aim: The purpose of this study was to compare thyroid gland morphology among patients on chronic hemodialysis (HD) and healthy participants and to assess the duration of dialysis on thyroid disorders. Material and methods: Prospective study included 80 participants divided into two groups. Study group included 40 patients on (HD) who were divided in two subgroups, according to the time spent on dialysis (i.e. under and over 72 months). The exclusion criteria was represented by the previous thyroid disorders and systemic illnesses. The control group included 40 healthy participants. The blood samples were taken for standard laboratory analysis, total and free thyroid hormone levels. Results: Thyroid ultrasound was performed, thyroid volume was calculated and the echostructure assessed. Mean values of thyroid volume were increased in HD patients (e.g.18.88 ± 3.20 ml, p<0.01). Diffuse goiter was found in 35% (n = 14) patients on HD (p = 0.01). In a subgroup of patients (i.e. with time on HD <72 months), the significant and more frequent was multinodular goiter, in 15.38% (n = 4) (p = 0.03). There was no significant correlation between the time on dialysis, thyroid volume (r=-0.05, NS) and TSH levels (r=0.14, NS). A significant, positive correlation between the thyroid volume and TSH levels was observed in HD group of patients (r=0.24 p<0.05).

Conclusion: Thyroid disorders are more common in patients on HD compared to general population. These findings suggest that thyroid morphology screening should be performed in HD patients. Key words: Thyroid volume, morphology, goiter, hemodialysis, TSH, CKD.

1. INTRODUCTION

Chronic kidney disease (CKD) and hemodialysis (HD) are responsible for several metabolic and hormonal disorders, including changes in thyroid gland morphology (1). Concentration of serum iodine, in patients with CKD is higher, due to lower iodine clearance caused by the reduced glomerular filtration. Elevated levels of serum inorganic iodine in patients with CKD may potentially block thyroid hormone synthesis (Wolf-Chaikoff effect), which can explain the higher prevalence of diffuse goiter and hypothyroidism in these patients (2).

CKD affects the size of the thyroid gland (3). Thus, in these patients prevalence of goiter is increased, mainly in women (4). Additionally, the thyroid nodules and thyroid cancer are more common in patients with CKD as opposed to a general population. Patients on HD have a higher risk of oncogenesis probably caused by dialysis disturbed cellular immunity. Patients after kidney transplantation are at even greater risk due to the influence of the immunosuppressive drugs (5).

The aim of this study was to compare the thyroid morphology among patients on chronic hemodialysis (HD), healthy participants and to assess if there is an association between the dialysis duration and morphology thyroid disorders.

2. MATERIALS AND METHODS

A prospective single center study, lasting for 12 months, included 80 participants, divided in two groups. First group included 40 stable patients on chronic haemodialysis program that lasted longer than three months, with a different etiology of renal diseases. Exclusion criteria were previous thyroid disorders and systemic illnesses. The control group included 40 healthy participants. The average time on dialysis was 60.32± 36.18 months (Table 1). There was no statistically significant difference between genders and average age between two groups. The average body mass index (BMI) was statistically significantly lower in hemodialysed group.

To assess the possible relation between thyroid morphology disorders and time on dialysis, participants of HD group were divided into two subgroups: subgroup A (patients on dialysis < 72 months) and B (patients on di-
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Blood samples were taken fasting and before dialysis treatment and heparin administration. The following parameters were assessed: total protein, albumin, creatinine, uric acid, cholesterol, triglycerides, and TSH using Architect c 8000 Abbott. Hemoglobin and red blood cell count was assessed by standard laboratory measurements using SISMEX T3, T4, and TSH were assessed using Architect i2000 Abbott TSH (IRMA) by means of standard laboratory methods.

Statistical analysis

Data are expressed as means ± standard deviations. Statistical differences in the variables were tested using parametric and nonparametric tests where appropriate. The relationship between

<table>
<thead>
<tr>
<th>Variables</th>
<th>Subgroup A (n=26)</th>
<th>Subgroup B (n=14)</th>
<th>Total</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average age (yr; mean ± SD)</td>
<td>54.35 ± 12.582</td>
<td>51.29 ± 10.194</td>
<td>53.28 ± 11.76</td>
<td>0.4396</td>
</tr>
<tr>
<td>Female gender (% )</td>
<td>15 (57.00%)</td>
<td>7 (50.00%)</td>
<td>22 (55.00%)</td>
<td>0.641</td>
</tr>
<tr>
<td>Male gender (% )</td>
<td>11 (42.30%)</td>
<td>7 (50.00%)</td>
<td>18 (45%)</td>
<td>0.641</td>
</tr>
<tr>
<td>BMI (kg/m²; mean ± SD)</td>
<td>22.96 ± 2.072</td>
<td>23.50 ± 2.312</td>
<td>23.15 ± 2.070</td>
<td>0.4398</td>
</tr>
<tr>
<td>GFR mL/min/1.73m²; mean ± SD</td>
<td>12.35 ± 1.981</td>
<td>12.36 ± 2.072</td>
<td>12.35 ± 1.981</td>
<td>0.9869</td>
</tr>
</tbody>
</table>

Table 1. Selected characteristics of study patients (data are presented as mean ± SD)

<table>
<thead>
<tr>
<th>Morphology disorders</th>
<th>HD group</th>
<th>Control group</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without disorders</td>
<td>12</td>
<td>30.00</td>
<td>30</td>
</tr>
<tr>
<td>Nodular goitre</td>
<td>10</td>
<td>25.00</td>
<td>5</td>
</tr>
<tr>
<td>Diffuse goitre</td>
<td>14</td>
<td>35.00</td>
<td>3</td>
</tr>
<tr>
<td>Hashimoto</td>
<td>4</td>
<td>10.00</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>100.00</td>
<td>40</td>
</tr>
</tbody>
</table>

Table 3. Absolute and relative frequencies of thyroid morphology disorders among groups

Nodular goiter and ultrasound changes suggestive for Hashimoto thyroiditis were also observed more frequently in HD group, but without significance. Mean thyroid volume values was significantly higher in HD group (18.88 ± 3.20 mL), comparing to control group (10.71 ± 4.32 mL)(p< 0.0001). Figure 2

Figure 1. Percentage of underlaying diseases in HD group

Figure 2. Presence of thyroid morphology disorders considering underlying renal diseases

The ultrasonographic examination of thyroid gland was performed with 7.5MHz probe and 50 mm linear transducer. Three consecutive measurements were taken for each thyroid lobe, than the thyroid volume for each lobe was calculated with the formula:

\[ V = \frac{a \times b \times c}{6} \times n \]

In this formula n/6 represents the correction factor measuring 0.479 (6). A total thyroid volume was calculated as a sum of lobe volumes. After the thyroid volume measurement the thyroid echostructure was estimated. The thyroid gland was especially examined regarding the nodules presence. Simple goitre is defined with elevated thyroid volume > 20ml (7). Nodular goiter is defined with presence of one node in either of thyroid lobe, multinodular goiter id is defined with two or more nodules in thyroid lobes (7). Morphology signs of autoimmune thyroid disease (Hashimoto thyroiditis) is defined with finding irregular pathognomonic ultrasound echostructure (8).
shows that presence of morphological impairment did not differ statistically between underlying diseases. There was no significant correlation between the time on dialysis and thyroid volume (r=-0.05, NS) and TSH levels (r=0.14, NS). A significant positive correlation between the thyroid volume and TSH levels was observed in HD group of patients (r=0.24 p<0.05).

Analysing morphology disorders between two subgroups there was no statistically significant difference between subgroups in the frequency of nodular goiter, diffuse goiter, ultrasound changes suggestive for Hashimoto thyroiditis and thyroid volume. Differentiated nodular goiter into uninodular and multinodular we found statistically significant more frequent multinodular goiter in subgroup A comparing to subgroup B (15.38% n=4 vs. 0.00% n= 0, p <0.05).

4. DISCUSSION

We aimed to assess spectrum of thyroid morphology disorders in patients on chronic hemodialysis and possible conection between time on dialysis and thyroid disorders.

In our study at least one thyroid morphology disorder were observed in 70% patients of HD group comparing 25% in control group. We found significantly higher mean values of thyroid volume in HD group, compared to the control group (18.88 ± 3.20 vs. 10.71 ± 4.32 ml, p = 0.0001). We observed a significantly higher frequency of diffuse goiter in HD group (35% vs. 7.5%, p= 0.001). Frequency of nodular goiter in our results was higher in the HD group but without statistical significance (25% vs. 12.5%, p = 0147).

We confirmed a statistically significant correlation between thyroid volume and TSH level. We did not found statistically significant correlation between morphological and functional thyroid disorders with underlying disease, age and sex in HD group.

In the subgroup of patients on HD < 72 months multinodular goiter (15.38% vs. 0.00, p=0.030) was found significantly more frequently comparing to patients on HD > 72 months (19.23% vs. 0.00%, p = 0.013). Kutlay et al. (3) and Lebkovska et al. (9) in their studies found no relationship between duration of dialysis treatment and abnormalities in the morphology of the thyroid gland. Kaptein EM (10) among their subjects on HD has found a higher incidence of diffuse goiter with increased length of dialysis treatment, as follows: in 39% of patients with HD duration <1 year and 50% of patients with duration of dialysis> 1 year.

Ching et al. in 2002 (11) in their study examined the effect of the length of peritoneal dialysis on thyroid nodules. According to their results, there was an increased incidence of nodular goiter among patients with longer duration of continious ambulatory peritoneal dialysis (CAPD) than patients without goiter (51.6 +/- 42.9 vs. 31.0 +/- 28.1 months, p<0.02). The difference between lengths of dialysis in the two studies may depend on the different modalities of dialysis. Patients on HD are subject to rapid loss of residual renal function compared to patients on CAPD.

5. CONCLUSION

Our study showed that morphology thyroid gland disorders are more common among patients on HD compared with healthy subjects, and reveal their link with time on dialysis. Due to increased risk of oncogenesis in these patients it is necessary to conduct periodic ultrasound screening of thyroid morphology in patients with CKD, HD and transplant patients. In patients who are waiting for a kidney transplant, early diagnosis and treatment of thyroid disease significantly reduce morbidity and mortality.

REFERENCES