STUDY OF SERUM ELECTROLYTES IMBALANCES IN FEMALE THYROID PATIENTS AT AIIMS, PATNA: A HOSPITAL BASED COMPARATIVE STUDY.
Dr. Jyoti Kumari¹, Dr. Dev Kant², Dr. Mala Mahto³

¹Dr. Jyoti Kumari, Senior Resident. Department of Biochemistry, AIIMS, Patna, Bihar, India.
²Dr. Dev Kant, Senior Resident, Department of Ophthalmology, VIMS, Pawapuri, Bihar, India.
³Dr. Mala Mahto, Associate Professor, Department of Biochemistry, AIIMS, Patna, Bihar, India.

Abstract

Objective: This present study was to compare the serum electrolytes (Na, K and Cl) imbalances in hypothyroidism, hyperthyroidism with euthyroidism female cases.

Methods: A detail history, clinical examinations and relevant investigations were performed to all female thyroid cases. Thyroid hormones were estimated by chemiluminiscence method using Siemens Advia Centaur XP instrument. Electrolyte levels (Na+, K+ & Cl-) were measured by ion selective electrode method using Eschweiler combi.

Results: Data was analyzed with the help of SPSS (version 26) software. Paired samples statistics was used. Mean ± standard deviation and t value were calculated. P value was taken less than or equal to 0.05 (p ≤ 0.05) for significant differences.

Conclusions: This present study concluded that electrolytes sodium, potassium and chloride levels were significantly reduced in hypothyroidism female cases compared to euthyroids female (controls). This suggests that hypothyroid patients should be regularly checked for serum electrolytes. Early detection and treatment can prevent the further complications related to the disorder and will be helpful during the management of thyroid patients.

Key words: Hypothyroidism, hyperthyroidism, euthyroidism, electrolytes.

Introduction

Thyroid disease is a most common endocrine disorder in the world. Hypothyroidism is ten times more common in women than men and its prevalence increases with age [1]. Hypothyroidism is a common endocrine disorder with a reported prevalence of 4%-10% [2]. Hypothyroidism and hyperthyroidism are the two primary pathological conditions that involve the thyroid glands. In India, hypothyroidism is the major thyroid dysfunction disorder [3]. Thyroid hormones are major regulator of basal metabolic rate and thermoregulation. The influences of electrolytes on thyroid hormones are not well established yet and so the underlying mechanisms are also; not well understood [4].

Hypothyroidism is accompanied by remarkable alterations in the metabolism of water and electrolytes [5]. Sodium and potassium are important components of the enzyme sodium potassium ATPase which is a cell membrane enzyme that helps in the transport of water and nutrients across the cell membrane. Thyroid hormones regulate the activity of sodium potassium pumps in most of the tissues. Prospective studies show that hypothyroidism is associated with hyponatraemia[6,7].

In recent years research has focused on outcomes of patients with electrolyte disorders, mainly hypo- and hypernatraemia, which were found to be associated with increased mortality [8]. But also disorders of potassium, phosphate and magnesium showed to be predictors for increased mortality [9]. Thyroid hormone is a central regulator of body haemodynamics, thermoregulation and metabolism. It therefore has an influence on renal haemodynamics, glomerular filtration, as well as the
renin angiotensin aldosterone system and renal electrolyte handling [10].

In many literatures different electrolyte disorders are associated with thyroid dysfunction. In severe hypothyroidism and myxoedema hyponatraemia is described to be a consequence of enhanced renal water retention mediated by vasopressin. On the other hand, hypokalaemia, hypomagnesaemia and hypercalcaemia were mentioned in patients with thyrotoxicosis [11]. Objective of our study was to compare the serum electrolytes imbalances in female thyroid patients.

MATERIALS & METHODS

This study was conducted in Department of Biochemistry, AIIMS, Patna, Bihar, India during a period from January 2018 to September 2018.

A total of 75 female thyroid patients with age group 20 years to 50 years were enrolled in this study. All 75 females were categorized into three groups on the basis of level of thyroid hormones, which are as: group I: hypothyroidism, group II: hyperthyroidism and group III: euthyroidism (control). Each group had 25 females. Entire subject signed an informed consent approved by institutional ethical committee of AIIMS, Patna was sought. Patients with history of intake of thyroid drugs, hypertensive, diabetes mellitus, and obesity were excluded from this study.

Methods:

A detail history, clinical examinations and relevant investigations were performed to all subjects.

**Estimation of thyroid hormones:** Thyroid hormones were estimated by chemiluminescence method using Siemen Advia Centaur XP instrument. Electrolyte levels (Na+, k+ & Cl-) were measured by ion selective electrode method using[5] Eschweiler combi in all the groups. 5ml venous blood was collected using plain test tube and subjected to centrifugation. Serum levels of free T3, T4 and TSH were obtained. Normal ranges for TSH, FT4 and FT3 were 0.35–5.5 µIU/L, 11.5–22.7 pmol/L and 3.5–6.5 pmol/L, respectively.

**STATISTICAL ANALYSIS**

Data was analyzed with the help of SPSS (version 26) software. Paired samples statistics was used. Mean ± standard deviation and t value were calculated. P value was taken less than or equal to 0.05 (p ≤ 0.05) for significant differences.

**OBSERVATIONS**

In this present study, a total of 75 female with thyroid disorders were selected. Out of 75, patients were categorized into three groups (group I: hypothyroidism, group II: hyperthyroidism and group III: (control: euthyroidism). Each group had 25 females. Average mean age in years of group I, group II and group III cases were 33.760 ± 7.031, 40.280 ± 7.807 and 41.960 ± 10.285 respectively.

<table>
<thead>
<tr>
<th>Table 1: Age of female thyroid cases</th>
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<tr>
<td>Hypothyroidism</td>
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<tr>
<td>Mean ± S.D. (Years)</td>
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<td>33.760±7.031</td>
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<th>Table 2: Comparison of cases of hypothyroidism with euthyroidism.</th>
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<td>Serum (meq/L)</td>
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<td>----------------</td>
</tr>
<tr>
<td>Na</td>
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<tr>
<td>K</td>
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<tr>
<td>Cl</td>
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A very significant mean difference of serum electrolytes (Na+, k+ & Cl-) of females with hypothyroidism (group I) with euthyroidism (group III) was seen in this study (P < 0.05).

| Table 3: Comparisons of cases with hyperthyroidism with euthyroidism. |

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Similarly, when mean ± S.D. of serum electrolytes (Na+, K+ & Cl-) of group II cases were compared with group III cases. P value was found 0.105, 0.167 and 0.186 respectively. Hence, mean differences of electrolyte of group II between group III was not statistically significant differences (p>0.05).

DISCUSSIONS

Hypothyroidism is one of the most common forms of thyroid dysfunction resulting from the deficiency of thyroid hormones or from their impaired activity[13]. Several studies have suggested that hypothyroidism could be a cause of hypokalemia[12] and that of hyponatremia in hypothyroidism is due to a pure renal mechanism. The effect of thyroid hormones on electrolytes and minerals has not been well established and the underlying mechanism is not well understood also[13].

Jaskiran Kaur et al. concluded that all age group presented with a high prevalence of hypothyroidism, higher number of subjects was observed between age group of 31-41 years of age[13]. Amrut A Dambal D, et al. found the mean age among the hypothyroidism and euthyroidism are 35.68±8.91 and 35.78±8.85 years respectively[14].

In our study, average mean ages of hypothyroidism of female patients were 33.760 ±7.031 years and hyperthyroidism females were 40.280 ± 7.807 years.

According to Saruta et al. Plasma Renin Activity (PRA) and Plasma Aldosterone (PA) levels may be repressed in hypothyroidism. This may be due to dysfunction of juxta-glomerular and glomerulosa cells respectively. The exaggerated sodium excretion and reduction in potassium excretion could be possibility for the suppression of renin activity and aldosterone in hypothyroid patients[15].

There are few studies which explain the theoretical mechanisms of association between thyroid function and sodium levels. The release of anti-diuretic hormone and increased urinary sodium loss were the probable mechanisms for the impaired urinary dilution which might be due to hypothyroid induced hyponatremia in rats[16,17].

Recent studies show that the newly diagnosed hypothyroidism and hyponatremia could help to decide whether the electrolyte disorder really resolves itself after starting hormone changeover. Hyponatremia has been frequently associated with greater risk of falls and fractures[18,19].

The Na-K ATPase, which is an enzyme localized on the cell membrane that helps in the passage of water and nutrients across the cell membrane. Sodium and potassium are important components of this enzyme. In most of the tissues, the activity of sodium potassium pumps is regulated by the thyroid hormones. In hypothyroidism, this enzyme is affected due to deficiency of thyroid hormones and low potassium levels which leads to accumulation of water inside the cells leading to edema[20].

In this present study, the sodium and chlorine levels of group I (hypothyroidism) females were markedly decreased as compared to (controls) group III (p=0.000). This was highly significant difference. As well as the potassium levels were also significantly diminished in cases of hypothyroidism compared to euthyroidism (controls) (p=0.007). But, there was not statically significant differences of electrolytes (Na, K & Cl) seen in hyperthyroidism females as compared with euthyroidism females (p>0.05).

Our findings also correlated the findings of Krishna MCS, et al. They concluded that electrolytes potassium, sodium and chloride levels were reduced in hypothyroidism compared to controls (euthyroids)[21].

CONCLUSIONS

This present study concluded that electrolytes sodium potassium and chloride levels were significantly reduced in hypothyroidism female cases compared to euthyroids female (controls). This suggests that hypothyroid patients should be regularly checked for serum electrolytes. Early detection and treatment can prevent the further
complications related to the disorder and will be helpful during the management of thyroid patients.

REFERENCES