Research Article

Evaluation of serum electrolytes in hypothyroid patients

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Abstract

Introduction: Thyroid hormones influence the water and electrolyte balance in the body. Hypothyroidism affects electrolyte levels but the underlying mechanism is not well understood. The objective is to find out the alterations in serum electrolytes in patients with subclinical hypothyroidism (SH) and overt hypothyroidism (OH) and to compare them with euthyroid subjects and also to assess the correlation between thyroid stimulating hormone (TSH) and serum electrolytes. **Material and Methods:** The study was conducted in the department of Biochemistry, tertiary care center, North Karnataka. Blood sample were collected from all the participants, thyroid profile and electrolytes were measured. Participants were grouped into, group-1: Euthyroid (n=50), Group-2: SH (n=50) and Group-3: OH (n=50). **Results:** Our study shows the mean serum sodium, potassium and chloride levels were significantly ($p<0.001$) lower in SCH and OH when compared to euthyroids. There is a negative correlation between TSH with serum sodium and potassium.
Conclusion: The serum sodium, potassium and chloride levels are significantly reduced in subclinical and overt hypothyroidism. Hence early detection and supplementation of the electrolytes in hypothyroidism patients may help in prevention of disease progress.
Keywords: Sodium, Potassium, Chloride, Hypothyroidism

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INTRODUCTION

Thyroid hormones play key role in basic metabolic rate and whole metabolism in general[1]. Hypothyroidism is the most common form of thyroid dysfunction. The mean annual incidence of hypothyroidism is up to 4 per 1000 women, 1 per 1000 men and 1 in 4000 newborns. The prevalence of overt hypothyroidism increases with age[2]. Thyroid hormones are necessary for the maintenance of water and electrolyte homeostasis. Hypothyroidism is accompanied by remarkable alterations in the metabolism of water and electrolytes[3-4]. 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[5]. Prospective studies show that hypothyroidism is associated with hyponatraemia[6-8]. An impaired urinary dilution capacity due to non-osmotic release of anti-diuretic hormone, as well as increased urine sodium loss is the major mechanism for hypothyroid induced hyponatremia in rats[9]. Hyponatremia was recently associated with an increased risk of fall, unsteadiness and fractures especially in elders[10]. Kidney disorder is among one of the adverse effect of myxedema with life threatening condition due to hyponatremia, cardiovascular and cerebral disorders[11]. Effect of thyroid hormones on electrolytes has not been established and also underlying mechanism is not well understood. Only few studies are available on subclinical hypothyroidism (SCH). Hence the present study is undertaken to assess the alterations in the levels of serum electrolyte profile in subclinical hypothyroidism (SCH) and overt

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hypothyroidism (OH) and compare them with euthyroid subjects. We also assessed the correlation between TSH and serum electrolyte levels.

MATERIAL AND METHODS

The study was conducted in the department of Biochemistry, from November 2013 to June 2014. The Study subjects were selected from patients undergoing thyroid evaluation in S Nijalingappa medical college and Sri Hanagal Kumareshwara Hospital and research centre, Bagalkot, North Karnataka. Among them 150 participants were selected, 50 subclinical hypothyroid cases, 50 overt hyperthyroid cases and 50 age and sex matched controls with normal thyroid profile (euthyroids) were chosen. The study subjects were in the age group of 20-60 years. Recently diagnosed and untreated cases were selected. A detailed clinical examination and history was taken to know if the subjects were taking any medications. The exclusion criteria includes diabetes mellitus, micro- and mcro-vascular complications , frank proteinuria detected by albustix, cigarette smoking, on diuretics, beta blockers, thyroid supplementation and antithyroid agents. 3 mL of venous blood sample was collected from all the participants under aseptic precaution and serum was separated. Informed written consent was obtained from all the participating subjects. The study protocol was approved by the institutional ethical committee. The serum sample was used for analyzing thyroid profile and electrolytes. Thyroid profile includes TSH, FT3 and FT4 were estimated by chemiluminescence immunoassay method by using MAGLUMI-1000, SNIBE. Electrolytes sodium (Na^+), potassium (K^+) and chloride (Cl^-) were estimated by ion sensitive electrodes (ISE) of ESCHWEILER, Combiline. The results were analyzed by using statistical package for social sciences (SPSS) of version 11. The results were expressed in terms of mean ± SD. The analysis of variance (ANOVA) test was applied for comparison of three groups and 'F' value is given. Pearson's correlation test is applied. A p-value of < 0.05 is considered as statistical significance.

RESULTS

Table-1 shows thyroid profile and electrolyte profile of the different groups. There is significant ($p<0.0001$) between mean serum levels of TSH, FT3 and FT4 levels in SCH and OH when compared to euthyroids. Our study shows that the mean serum sodium, potassium and chloride levels were significantly reduced in patients with SCH and OH when compared to euthyroid subjects ($p<0.05$). Table-2 shows the correlation of TSH with serum sodium, potassium and chlorides in patients with OH and SCH. The statistical analysis shows a statistically significant negative correlation between TSH and serum sodium (r = -o.429), TSH and serum potassium (r = -0.145) in patients with OH. In patients with SCH statistically significant negative correlation between TSH and serum sodium (r = -o.273), TSH and serum potassium (r = -0.399). At the same time there is no statistical significant correlation observed between TSH and serum chloride levels in both the groups.

Table 1: Comparison of Thyroid profile and electrolyte profile among different groups

Parameters	Euthyroid	Subclinical Hypothyroidism	Overt Hypothyroidism	ANOVA F	p-value
TSH mIU/L	2.34 ± 1.25	10.12 ± 7.25	54.78 ± 40.42	53.84	0.0001
FT3 pg/mL	2.7 ± 0.83	3.13 ± 1.81	1.66 ± 0.81	16.68	0.0001
FT4 pg/mL	10.3 ± 2.1	11.63 ± 2.05	4.31 ± 2.11	164.78	0.0001
Sodium mmol/L	139.5 ± 3.2	137.3 ± 2.83	134.8 ± 2.12	26.49	0.0001
Potassium mmol/L	3.9 ± 0.19	3.85 ± 0.38	3.37 ± 0.24	48.55	0.0001
Chloride mmol/L	103 ± 0.28	103.09 ± 1.7	102.02 ± 3.27	3.48	0.03

p< 0.05 statistically significant

Table 2: Correlation of TSH with electrolytes in overt and subclinical hypothyroidism

Groups	Correlation	r value	p value
Overt Hypothyroidism	TSH vs Na	- 0.429	< 0.003
	TSH vs K	- 0.145	< 0.03
	TSH vs Cl	- 0.051	0.7
Subclinical Hypothyroidism	TSH vs Na	- 0.273	0.07
	TSH vs K	- 0.399	0.007
	TSH vs Cl	- 0.133	0.384

p< 0.05 statistically significant

DISCUSSION

Thyroid hormones act as central regulator of various body functions i.e. metabolism and hemodynamics. So it has an influence on renal hemodynamics, glomerular filtertion and electrolyte handling. Hypothyroidism is a condition in which the body suffers from insufficient thyroid hormones, the patient suffer from slow metabolism resulting in electrolyte disturbance. In the present study we found that significant decrease in the levels of serum sodium and potassium levels in SCH and OH when

compared to controls ($p < 0.0001$). Our findings are in accordance with Roopa[12], Schwarz[13] and Jaskiran kaur[14]. Schwarz[13] states that hyponatremia and hypokalemia was more common in patients with elevated TSH compared to those with normal TSH. Our findings are contradictory to Abedelmula M, *et al*[15], concludes that significant increase in serum potassium levels in hypothyroid group compared to controls. We also found that there was a significant negative correlation between TSH with sodium and potassium levels which is in accordance with Schwarz[13]. Several studies suggested that hypothyroidism could be a cause of hypokalemia and that hyponatremia in hypothyroidism is due to a pure renal mechanism. Thyroid hormones regulate the activity of sodium potassium pumps in most of the tissues. In hypothyroidism because of low potassium levels and deficiency of thyroid hormones sodium-potassium ATPase is affected, resulting in accumulation of water in the interstitial space causing edema[5]. In our study we found significant decrease ($p< 0.05$) in the serum chloride levels in SCH and OH when compared to controls which is in accordance with Schwarz. Hypochloraemia was more common in patients with high TSH than in those with normal TSH. There is no correlation with serum TSH and chloride levels.

CONCLUSION

This study concludes that significant decrease in the levels of serum sodium, potassium and chloride levels in SCH and OH compared to controls. There is a negative correlation between TSH and serum sodium and potassium. This suggests that hypothyroid patients to be regularly checked for disturbances in serum electrolytes and electrolyte profile should be routinely done along with thyroid profile. Early detection and treatment by supplementation can prevent the further damage associated with these electrolytes.

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