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RESEARCH ARTICLE

THE ELECTROLYTES IMBALANCE BETWEEN HYPOTHYROIDISM AND HYPERTHYROIDISM

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ABSTRACT

Introduction: Thyroid hormone is one of the central regulator of body functions. The effect of thyroid hormones on electrolytes has not been well established and the underlying mechanisms are not well understood. Only few data on the association between thyroid function and electrolyte disorders exists. Thus our aim was to find out the electrolytes imbalance between hypo and hyperthyroidism and their correlation.

Materials and Methods: 60 patients and 30 controls were included in this study. Thyroid hormones (T3, T4 and TSH) were measured by Beckman coulter Access-2 auto analyser and Serum sodium, potassium and chlorides were estimated using Ion Selective Electrodes. Statistical analysis was done using SPSS 16.

Results: Patients with hypothyroidism showed significant decrease in serum sodium, potassium and chloride levels ($p<0.05$) and Patients with hyperthyroidism showed significant increase in serum potassium levels ($p<0.05$). When correlated with TSH, Serum sodium and potassium showed negative correlation where it has positive for serum chloride in case of hypothyroidism. For hyperthyroid patients, correlation was negative for serum sodium and chloride whereas positive for serum potassium.

Conclusion: The results of this study indicate that the serum electrolytes were significantly imbalanced in hypothyroid and hyperthyroidism patients. They should be regularly checked for serum electrolytes to prevent possible complications.

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INTRODUCTION

Thyroid disease is common in the general population, and the prevalence increases with age. In India, 42 million people are suffering from thyroid diseases; hypothyroidism being the commonest thyroid disorder (Unnikrishnan and Menon, 2011).Electrolytes play an important role in many body processes, such as controlling fluid levels, acid-base balance (pH), nerve conduction, blood clotting and muscle contraction(Rao, 1992). Thyroid hormone is a central regulator of body haemodynamics, thermoregulation and metabolism. While the effect of thyroid hormones on lipid metabolism is well known, the effect on electrolytes has not been well established and also the underlying mechanisms are not well understood (Mariani and Berns, 2012).Sodium and potassium are important components of the enzymes Na^+-K^+ ATPase, which is an enzyme present on the cell membrane that helps in the transport of water and nutrients across the cell membrane (Murgod*et al*., 2012).Thyroid hormones regulate the activity of sodium potassium pumps in most of the tissues (Ismail and Edelman, 1971). Electrolyte disorders are common in hospitalised patients with dysnatremias being the most common ones (Adrogue and Madias, 2000; Adrogue and Madias, 2000). In recent years research has focused on outcomes of patients with electrolytedisorders, mainly hypo and hypernatremia, which were found to be associated with increased mortality (Lindner *et al*., 2007). In many literatures different electrolyte disorders are associated with thyroid dyfunction. In severe hypothyroidism and myxoedemahyponatremia is described to be a consequence of enhanced renal water retention mediated by vasopressin. On the other hand, hypokalaemia is mentioned in patients with tyrotoxicosis (Schwarza *et al*., 2012). The present study was undertaken to assess the alterations in the levels of serum electrolytes and the effects of Thyroid stimulating hormone (TSH) on serum electrolytes in hypothyroid and hyperthyroid patients.

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MATERIALS AND METHODS

Total of 60 clinically established patients and 30 controls of 18-75 years were included in this study. The study was conducted in Victoria hospital attached to BMC&RI. The patients were divided into three groups depending on thyroid hormone levels

as euthyroid (Controls), hypothyroid and hyperthyroid respectively. Patients with history of intake of thyroid drugs, hypertensive, diabetes mellitus, obesity, renal disorders and hepatic disorders were excluded from the study.

Method of Analysis

After written informed consent, 5ml of venous blood was obtained by venepuncture under aseptic conditions, Centrifuged and separated serum was used for estimation of thyroid hormones and electrolytes. Thyroid hormones were measured by Chemiluminescence Imunnoassay method on Beckman Coulter Access-2 auto-analyzer. The electrolytes, Na^+, K^+ and Cl^-levels were measured by Ion elective electrode. The results were tabulated. Results on continuous measurements are presented on Mean±SD (Min-max). The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1 , Syst at 12.0 and R environment ver.2.11.1 were used for the analysis of the data. The results of cases and controls were compared by student 't' test. A 'p" value of <0.05 was considered significant. A 'p' value of <0.0001 was considered as highly significant. All three parameters were compared with TSH levels. Pearson's correlation and t test of coefficient were calculated.

RESULTS

Table 1. Comparison between Controls and Hypothyroid patients

Lab variables	Controls	Patients	p value
T3(tri-iodothyronine)	1.21±0.18	0.94±0.2	<0.0001
T4(thyroxine)	9.84±1.35	4.93±1.46	<0.0001
TSH(Thyroid stimulating hormone)	2.58±1.22	45.02±36.03	<0.0001
Na^+	137.26±2.18	131.86±2.47	<0.0001
K^+	4.28±0.32	4.04±0.54	<0.0446
Cl^-	102.13±2.72	100.6±2.68	<0.0322

Table 2. Comparison between Controls and Hyperthyroid patients

Lab variables	**Controls**	**Patients**	**p value**
T3(tri-iodothyronine)	1.21±0.18	1.84±0.54	<0.0001
T4(thyroxine)	9.84±1.35	16.11±2.4	<0.0001
TSH(Thyroid stimulating hormone)	2.58±1.22	0.18±0.18	<0.0001
Na^+	137.26±2.18	134.23±18.61	0.3791
K^+	4.28±0.32	4.58±0.54	0.0115
Cl^-	102.13±2.72	101.43±2.19	0.2776

Table 3. Pearson's correlation coefficient (r) between electrolytes and TSH

TSH	**Correlation coefficient(Hypothyroidism)**	**Correlation coefficient(Hyperthyroidism)**
Na^+	-0.2775	-0.1777
K^+	-0.3455	0.1106
Cl^-	0.1304	-0.4169

DISCUSSION

Hypothyroidism is one of the most prevalent endocrine diseases. It can lead to a variety of clinical situations, including congestive heart failure, electrolyte disturbances and coma. Hyponatremia is the most common electrolyte abnormality encountered in clinical practice (Kargili *et al*., 2010). In our study, Table 1, the serum sodium levels in hypothyroidism was markedly decreased as compared to healthy controls (p<0.0001) whereas serum potassium and chloride levels were significantly decreased in hypothyroid patients as compared to controls (p<0.05). In hyperthyroid patients, Table 2, there was no significant difference in the levels of serum sodium, potassium and chloride when compared to controls. However statistically significant difference was seen in the level of potassium (p<0.05) but not in the levels of sodium and chloride (p>0.05) in case of hypothyroid patients. According to Saruta *et al*. Plasma Renin Activity (PRA) and Plasma Aldosterone (PA) may be suppressed in hypothyroidism probably due to dysfunction of juxtaglomerular cells and glomerulosa cells respectively and the possibility that suppression of PRA and PA in patients with hypothyroidism is related to exaggerated sodium excretion and decrease in potassium excretion cannot be ruled out (Saruta*et al*., 1980).The theoretical mechanisms explaining an association between thyroid function and serum sodium were reviewed recently (Mariani and Berns, 2012). An impaire durinary dilution capacity duetonon-osmotic release of anti-diureti chormone, as well as increase durine sodium loss was the major mechanism for hypothyroid induced hyponatremia in rats (Schmitt *et al*., 2003). Prospective studies with long term follow up in patients with newly diagnosed hypothyroidism and hyponatremia could help to determine whether the electrolyte disorder really resolves itself after starting hormone substitution. Hyponatremia was recently shown to be associated with an increased risk of falls and fractures, making the subject more relevant for patient's prognosis (Renneboog *et al*., 2006; Kinsella *et al*., 2010). Sodium and potassium are important components of the enzyme Na-K ATPase, which is an enzyme on the cell membrane 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. In

hypothyroidism, because of low potassium levels, and because of deficiency of thyroid hormones, this enzyme is affected, resulting in accumulation of water inside the cells and causing edema. This is said to be one of the mechanisms responsible for weight gain seen in hypothyroid patients (Murgod and Soans, 2012). In Table 3,We also correlated the levels of serum sodium, potassium and chloride with TSH. In case of hypothyroidism, serum sodium and potassium were negatively correlated with TSH but serum chloride was positively correlated. Whereas in case of hyperthyroidism, serum sodium and chloride were negatively correlated with TSH but serum potassium was positively correlated. None of the correlations were statistically significant. Morgood et al. showed significant negative correlation between TSH, serum sodium and potassium in hypothyroidism.

Conclusion

It has been shown in our study that serum sodium, potassium and chloride levels were decreased in hypothyroidism compared to euthyroids. But in case of hyperthyroidism there was no significant difference in the levels of measured electrolytes among the patients and controls. However significant increase in the levels of serum potassium was obtained in hyperthyroid patients. This suggests that hypothyroid and hyperthyroid patients will be having electrolyte imbalances and should be regularly checked for serum electrolytes. Also, electrolyte disturbances need to be monitored and treated appropriately to prevent further complications.

REFERENCES

Adrogue HJ, Madias NE. 2000. Hypernatremia. *N Engl J Med*., 342(20):1493–9.

Adrogue HJ, Madias NE. 2000. Hyponatremia. *N Engl J Med*., 342(21):1581–9.

Ismail BF, Edelman IS. 1971. The mechanism of the calorigenic effect of thyroid hormone stimulation of Na+ + K+ activated adenosinetri phosphatase activity. *J gen Physiol*., 57: 710.

Kargili A, Turgut FH, Karakurt F, Kasapoglu B, Kanbay M, Akcay A. 2010. A forgotten but important risk factor for severe hyponatremia: myxedema coma. Clinics (Sao-Paulo). 65:447-448.

Kinsella S, Moran S, Sullivan MO, Molloy MG, Eustace JA. 2010. Hyponatremiaindependent of osteoporosis is associated with fracture occurrence. *Clin J Am SocNephrol*., 5(2):275–80.

Lindner G, Funk GC, Schwarz C, Kneidinger N, Kaider A, Schneeweiss B, *et al*. 2007. Hypernatremia in the critically ill is an independent risk factor for mortality. *Am J Kidney Dis*., 50(6):952–7.

Mariani LH, Berns JS. 2012. The renal manifestations of thyroid disease. *J Am SocNephrol*., 23(1):22–6.

Mariani LH. andBerns JS. 2012. The renal manifestations of thyroid disease. *J Am SocNephrol*., 23(1): 22–26.

Murgod R. amdSoans G. 2012. Changes in Electrolyte and Lipid profile in Hypothyroidism. *International Journal of Life Science and Pharma Research*, 2(3): 185-194.

Rao GM. 1992. Serum electrolytes and osmolality in diabetes mellitus. *Indian J Med Sci*., 46(10):301-303.

RenneboogB,MuschW,VandemergelX,MantoMU,DecauxG. 2006. Mild chronic hyponatremia is associated with falls, unsteadiness, and attention deficits. *Am J Med*., 119(1):71 e1–8.

Saruta T, Kitajima W, Hayashi M, Kato E, Matsuki S. 1980. Renin and aldosterone in hypothyroidism: Relation to excretion of sodium and potassium. *ClinEndocrinol*., 12:483-489.

Schmitt R, Klussmann E, Kahl T, Ellison DH, Bachmann S. 2003. Renal expression of sodium transporters and aquaporin-2 in hypothyroid rats. *Am J Physiol Renal Physiol*., 284(5):F1097–104.

Schwarza C, Leichtle AB, Spiros A, Georg MF, Heins Z, Aristmenis K, Gregor L. 2012. Thyroid function and serum electrolytes. Swiss Medical Weekly, 13669 - 142.

Unnikrishnan AG, Menon UV. 2011. Thyroid disorders in India: An epidemiological perspective. *Indian J EndocrinolMetab*.,1 15:78-81.

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