

Comparative Study of Serum Calcium and Electrolytes in Adult Patients with or without Hypothyroidism

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Conflict of interest: Nil

Abstract:

Background: Thyroid hormones play an important role in the homeostasis of calcium and phosphorous levels through their direct action on bone turnover, but their levels are still not confirmed.

Method: Out of 200 subjects, 100 were known hypothyroid patients, and the remaining 100 were healthy volunteers. 3 ml of venous blood from these 200 people was studied. TSH levels were studied by the Monobind Acculite Thyroid TSH Kit. Serum calcium level was estimated by the Arsenazo III method, and serum electrolytes were measured by Easylytes Ion selective electrodes.

Results: Except chloride (Cl⁻), all electrolytes and calcium had significant decrease levels, and chloride level was highly increased 104.45 (\pm 7.50), t test was 4.67, and p<0.001. All parameters had a significant p value, but regression and negative correlation only calcium level (0.80) had significant p value (p<0.001).

Conclusion: The present pragmatic study indicates that there is a profound influence of thyroid hormones on serum electrolytes; serum calcium, sodium, and potassium levels were decreased, while chloride levels were significantly increased in hypothyroidism patients compared to normal subjects.

Keywords: Electrolytes, TSH, Monobind Acculite Thyroid Kit, Ar-Senazo III Method, Easy Lytes Ion-selective electrodes.

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Introduction

Dysfunction and anatomic abnormalities of the thyroid are among the most common diseases of the endocrine glands. Hypothyroidism and hyperthyroidism are two primary pathological conditions that involve the thyroid gland [1]. Hypothyroidism is one of the most common forms of thyroid dysfunction resulting from the deficiency of thyroid hormone or its unpaired activity [2]. Hypothyroidism is ten times more common in women than men, and its prevalence increases with age. A biochemical decrease in T3 and T4 concentrations leads to hypersecretion of pituitary TSH and an amplified increase in TSH levels. This is the key laboratory finding in the diagnosis of hypothyroidism [3]. Thyroid hormones perform a wide array of metabolic functions, including the regulation of lipids, carbohydrates, proteins, electrolytes, and mineral metabolism like calcium, potassium, sodium, and chloride [4]. Hence, an attempt is made to correlate TSH and hypothyroidism with levels of calcium and electrolytes.

Material and Method

100 (one hundred) patients who are known patients of hypothyroidism regularly visited the biochemis-

try department of Dhanalakshmi Srinivasan Medical College Hospital, Siruvachur, Perambalur (district), Tamil Nadu-621113 were studied.

Inclusive Criteria: Patients in the in the age group 20-50 years who are known for hypothyroidism. The patient who gave the consent in writing were selected for study.

Exclusion Criteria: Patients with hepatic, renal, or bone disease alcoholism. Diabetes mellitus was excluded from the study.

Method:

100 patients with hypothyroidism and 100 healthy volunteers (a controlled group) were studied and 3 ml of venous blood drawn from each person using a disposable plain vacutainer in fasting conditions were compared. Serum is separated within half an hour by centrifugation and stored at 2-8°C temperature until analysis is done. Analysis of serum TSH is measured by the Mono-bind Acculite Thyroid TSH Kit by using Neolumax's chemi luminescence immunoassay; serum total calcium level is estimated by the Ar-Senazo III method; and serum electrolytes are measured by Easylyte's ion selec-

tive electrodes. The results of the comparison were noted.

Duration of study: October 2022 to October 2023

Statistical Analysis: Various parameters of electrolytes calcium were compared with TSH by t test and correlation coefficient study. The statistical analysis was carried out in SPSS software. The ratio of males and females was 1:3.

Observation and Results

Table 1: Comparison of TSH serum calcium, sodium, potassium, and chlorides in the control group and cases: -

- TSH: 2.71 (± 1.30) in the controlled group
- Calcium: 10.05 (± 0.57) in the control group, 8.50 (± 0.43) in cases, t test was 21.2 and p<0.001.

- Sodium: 139.6 (± 2.90) in the control group, 124.3 (± 1.11) in the cases; the t test was 49.2 and p<0.001.
- Potassium: 4.32 (± 0.58) in the control group, 3.45 (± 0.28) in the cases; the t test was 13.5 and p<0.001.
- Chloride: 100.60 (± 3.40) in the control group, 104.45 (± 7.50) in cases, only chloride levels are increased, t test was 4.67 and p<0.001.

Table 2:

Correlation between serum calcium, sodium, potassium, and chloride with TSH (hypothyroid) THS V/s calcium: 0.80 in the r value and p<0.001 (the p value is highly significant).

TSH V/s calcium r value 0.04 and p<0.86, TSH V/s potassium -0.04 and p<0.86 TSH V/s chloride r value 0.15 and p<0.31

Table 1: Comparison of TSH, serum calcium, sodium, potassium and chlorides in control group cases

Parameter	Control group (100)	Cases (100)	t test	p value
TSH (Thyroid stimulating Hormone)	2.71 (± 1.30)			
Calcium (Ca ⁺²)	10.05 (± 0.57)	8.50 (± 0.43)	21.2	P<0.001
Sodium (Na ⁺)	139.6 (± 2.90)	124.3 (± 1.11)	49.2	P<0.001
Potassium (K ⁺)	432 (± 0.58)	13.45 (± 0.23)	13.5	P<0.001
Chloride (C ⁺)	100.60 (±3.40)	104.45(± 7.50)	4.67	P<0.001

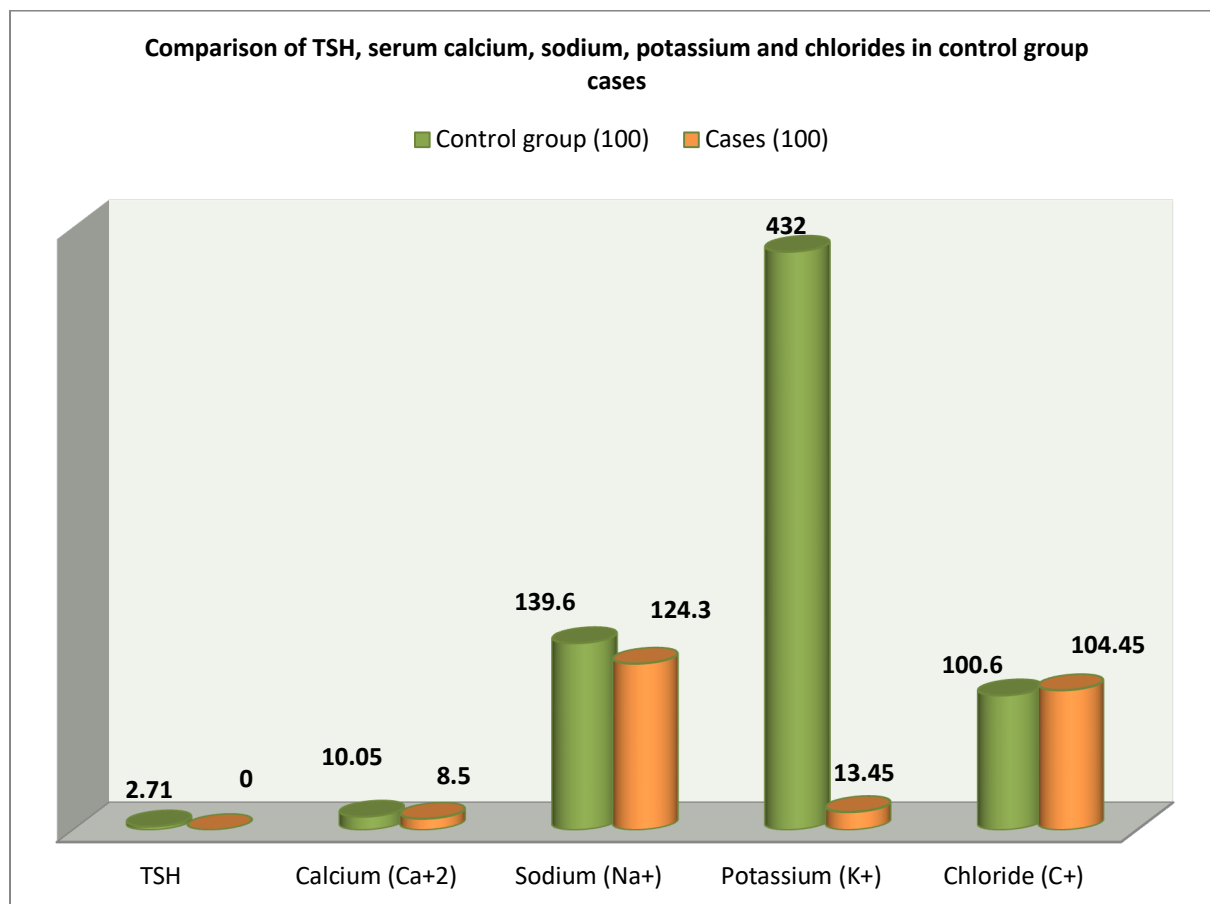


Figure 1: Comparison of TSH, serum calcium, sodium, potassium and chlorides in control group cases

Table 2: Correlation between serum calcium, sodium, potassium and chlorides with TSH among cases

Parameters (Hypothyroidism)	Correlation Coefficient (r value)	p value
TSH Vs Calcium	- 0.80	P<0.001 *
TSH Vs Potassium	- 0.04	p>0.86
TSH Vs Potassium	- 0.04	p>0.86
TSH Vs Chloride	- 0.15	p>0.31

(p<0.001) p value is highly significant only in TSH calcium

Discussion

Present study of serum calcium and electrolytes in adult patients of Tamil Nadu with or without hypothyroidism. In comparison of TSH, serum calcium, sodium, potassium, and chlorides in the control group and cases. There is a significant elevation of the chloride level to 104.45 (\pm 45), but the remaining electrolytes and calcium had decreased levels with a significant p value (p<0.001) (Table 1). In the correlative coefficient and regression equation, only TSH V/s calcium (0.80) was highly significant (p<0.001), but all remaining parameters like TSH V/s sodium, potassium, and chlorides had insignificant p values (Able 2). These findings are more or less in agreement with previous studies [5,6,7].

It is an established fact that, thyroid hormone is a central regulator of body hemodynamics, thermoregulation, and metabolism. It has an influence on renal hemodynamics, glomular filtration, and electrolyte handling [8]. Thyroid hormone affects the glomerular filtration rate (GFR) and blood flow and has a direct effect on calcium and magnesium resorption [9]. Thyroid hormone is essential for normal growth and maturation of the skeletal system. Decreased turnout due to impaired mobilization of calcium into bone is observed in hypothyroidism patients, leading to decreased blood calcium. Increased production of thyroid calcitonin, which promotes the tubular resorption of phosphate and facilitates the tubular excretion of calcium, leading to hypocalcaemia and hyperphosphatemia, is observed in hypothyroidism [10].

Sodium and potassium make up the up the vital composition of the enzyme, Na-K-ATpase, which is an enzyme on the cell membrane that helps transport water and essential nutrients across the membrane. Sodium, potassium pumps in most tissues are regulated by thyroid hormones, leading to a low potassium level in hypothyroidism and affecting the Na-K-ATpase activity, leading to the accumulation of water inside the cell and causing oedema. It could be one of the mechanisms responsible for the weight gain observed in hypothyroidism patients.

Moreover sub-clinical hypothyroidism has reported an increased risk of coronary heart disease events, heart failure, and cardiovascular mortality among affected adults. It is also found that hypothyroid patients are more susceptible to bone fractures [11].

Summary and Conclusion

Present a comparative study of serum calcium and electrolytes in patients with or without hypothyroidism in Tamil Nadu. It is observed that there is a profound influence of thyroid hormones on serum electrolytes. It was also noted that, there was a significant decrease in levels of calcium, sodium, and potassium except for chloride in hypothyroid patients. Early detection and proper treatment can prevent further complications like electrolyte imbalance in hypothyroid patients. The present study concludes that such clinical trials must be conducted on a large number of patients in high-tech endocrine centers to confirm the present significant results because the exact mechanism and factors of the secretion of thyroid hormones are still unclear.

Limitation of Study: Due to the tertiary location of the research center, the small number of patients, and the lack of the latest techniques, we have limited findings and results.

This research work has been approved by the ethical committee of the Dhanalakshmi Srinivasan Medical College hospital Sirivaschir, Perambalur (district), Tamil Nadu-621113

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