



ASSESSMENT OF SERUM CALCIUM AND PHOSPHORUS LEVELS IN NEWLY DIAGNOSED HYPOTHYROID PATIENTS

Physiology

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ABSTRACT

Background: Thyroid disease is a pathological condition, which affects the calcium and phosphorous metabolism. Abnormalities in the calcium and phosphorous homeostasis are known as disorders of the mineral metabolism.

Objective: To evaluate the effect of thyroid function on the serum calcium & phosphorus levels in newly diagnosed hypothyroid patients and to find out the effect of treatment on calcium and phosphorus levels.

Methods & Materials: In this study the patients are aged between 20 – 60 yrs. 30 newly diagnosed hypothyroid patients were included in this study and find out the mineral alterations before and after the treatment in 30 patients. Estimation of the biochemical parameters was done by standard methods.

Results: hypocalcaemia and hyperphosphatemia was observed before treatment in hypothyroid patients, but statistically not significant.

Discussion & Conclusion: This study concluded that the S.Ca⁺⁺ levels are decreased before treatment whereas S.PO₄ - levels are increased. S.Ca⁺⁺ & S.PO₄ not affected by gender. With the short duration of treatment serum Ca⁺⁺ & S.PO₄ becomes normal.

KEYWORDS

Calcium, Hypothyroidism, Phosphorus

INTRODUCTION:

The thyroid is one of the largest endocrine gland^[1]. The thyroid gland secretes two important hormones thyroxine and triiodothyronine, which are commonly known as T₄ and T₃. These hormones involved in the biological effects such as regulation of body haemodynamic, thermoregulation and various metabolisms^[2]. Less secretion of T₄ and T₃ leads to hypothyroidism. It was defined first in London in the 1870s what we call hypothyroidism was named Myxoedema because of swollen skin and its excess content of mucin. The prevalence of primary hypothyroidism is 10/1000 but increases to 50/1000 if patients with sub-clinical hypothyroidism. It is more common in women in the age between 20-45 years than men. The ratio of female to male is approximately 6:1. The common causes of hypothyroidism are Iodine deficiency, Auto immunity, Atrophic Thyroiditis, Hashimoto's thyroiditis and Drug-Induced Hypothyroidism^[3]. Hypothyroidism being the most prevalent endocrine disease, can lead to a variety of clinical situations including, electrolyte and mineral disturbances, congestive heart failure and coma. Calcium, phosphorous homeostasis were frequently disturbed in thyroid dysfunctions^[4]. Thyroid hormone is essential for the normal growth and maturation of skeleton^[5].

Previous studies done on serum calcium and phosphorus levels in thyroid disorders have conflicting results. Some studies have reported normal levels^{[6],[7]}, while others have reported decreased serum calcium and phosphorous levels in hypothyroidism^[8]. Some studies have reported the serum levels of Calcium were significantly decreased (p<0.001) and phosphorous levels were significantly increased. The aim of this study was to investigate the effects of hypothyroidism on serum calcium and Phosphorous. According to different case reports in the literature, mineral disturbances in any sort of thyroid dysfunction were possible.

METHODS & MATERIALS

This study was conducted at Karpaga Vinayaga Institute of Medical Sciences and Research Centre following approval by the Institutional Ethical Committee. In this study the patients are aged between 20 – 60 yrs. 30 newly diagnosed hypothyroid patients were included in this study and find out the mineral alterations before and after the treatment in 30 patients.

Inclusion criteria

Hypothyroid patients with TSH level >4.2mc IU/ML were included for this study

Exclusion criteria

All the subjects were enquired about their demographic and socioeconomic variables as well as their personal history of habits of alcohol intake, smoking, any drug history and general signs and symptoms related to hypothyroidism. Patients with diabetes mellitus,

alcoholism, liver and kidney diseases were excluded from the study.

After taking an informed consent, under complete aseptic precautions 5 ml of fasting venous blood was drawn in plain vacutainer tubes. Serum was separated by centrifugation. Serum T₃, T₄ and TSH were determined by Enzyme linked fluorescent assay (ELFA) by MINIVIDAS. Reference values for laboratory are T₃- 0.58-1.49 ng/ml, T₄ -4.61-9.3µg/dl, TSH – 0.25-5µIU/ml. Serum Calcium (reference value 9.0- 11 mg/dl) and Serum Phosphorus (reference value 3-4.5mg/dl), were estimated by using commercially available kits. Thereafter, all patients received appropriate doses of thyroxine treatment for hypothyroidism and were monthly followed for thyroid profile throughout 3 months of period. At the end of third month biochemical analysis were repeated.

STATISTICAL ANALYSIS: The mean values of all parameters in hypothyroidism were statistically analysed by applying paired 'T' test and calculated 'p' values by using SPSS 22 version.

RESULT

In 30 patients, 80% female and 20 % of male with hypothyroidism. The thyroid parameters like T₃, T₄, TSH and Serum Calcium, Serum Phosphorus of the study population before and after treatment were shown in Table 1. TT₃ and TT₄ levels were statistically not significant. TSH levels are increased in hypothyroid patients and after treatment approximately it was reduced to normal level and statistically significant. Serum calcium levels were decreased in hypothyroid patients whereas serum phosphorus levels were increased in patients but statistically not significant.

Table 1: Comparison of thyroid parameters and minerals in hypothyroidism before and after treatment

S. No	Variable	Before Treatment (n=25)	After Treatment (n=25)	P Value
1	TT3	2.02 ±2.9	1.30±0.50	0.185
2	TT4	4.27±2.86	5.16±2.4	0.24
3	TSH	32.7±11.96	5.4±2.15	0.000 *
4	SCa ²⁺	9.41±0.33	9.75±0.46	0.078
5	SPO ₄	4.57±1.35	4.58±0.91	0.98

DISCUSSION:

Thyroid hormones regulate body hemodynamic, thermoregulation and metabolism. They have an influence on renal hemodynamic, glomerular filtration and electrolyte handling⁹. The aim of this study was to investigate the effects of hypothyroidism on serum calcium and Phosphorous. According to different case reports in the literature, mineral disturbances in any sort of thyroid dysfunction were possible.

In this study, all hypothyroid patients had significantly higher TSH

levels and lower TT_3 and TT_4 levels before the appropriate treatment. After short duration of treatment TSH were significantly normal and TT_3 , TT_4 were statistically not significant. Based on the findings of our study, it was inferred that mineral metabolism has intimate association with thyroid hormones. Thyroid hormones determine the mineral pool in the blood by regulating mobilization of calcium and phosphorous. According to Eriksen 1985 & 1986 et al, Calcium & phosphorous levels in hypothyroidism are usually normal but calcium may be slightly elevated. Calcium balance is also variable & any changes in the serum calcium levels are slight. The exchangeable pool of calcium & its rate of turnover are reduced; changes that reflect decreased bone formation and resorption^[10, 11]. In our study, mean value of serum calcium levels were low in hypothyroid patients. It was supported with Shivallela MB et al^[12]. Hypocalcaemia may cause neuromuscular irritability including perioral paraesthesia, tingling of toes & fingers, spontaneous or latent tetany (Bringhurst et al., 2003)^[13]. Serum phosphorous levels were increased slightly in hypothyroid patients. Study carried out at India 2011 by B. Suneel et al^[14] reported that in hypothyroid patients the serum levels of Calcium were significantly decreased ($p < 0.001$) and phosphorous levels were significantly increased ($p < 0.001$) compared to controls. Study carried out at Switzerland in 2012 by (Christoph Schwarza et al) reported that phosphate levels were higher in patients with elevated TSH than in patients with normal TSH ($p < 0.01$)^[15].

CONCLUSION: Our study concludes that serum calcium level was decreased and Serum phosphorous levels were increased in hypothyroidism. Hypothyroid patients need to be regularly evaluated for serum calcium; phosphorous as early detection can prevent further complications from mineral metabolism dysfunction. The limitation of the study was small sample size. Duration of the study also less. We don't have control group. In future the sample size and duration of the study will be increased.

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CONFLICTS OF INTERESTS

The authors do not have any conflict of interest.

REFERENCES

- Shlomo Melmed, Kenneth S. Polonsky P. Reed Larsen, Henry M. Kronenberg. Williams Textbook of Endocrinology 13th edition 2016 page number no 335.
- Susanna TY, sagayaraj A, shashidhar KN, gomathi M, Mahesh V. A correlative study of thyroid profile and mineral status in patients with hypothyroidism - A hospital-based case control study. Asian J Pharm Clin Res, Vol 9, Issue 3, 2016, 292-294.
- Lewis E. Braverman, Robert D. Utiger, and Werner & Ingbar's; "The Thyroid a Fundamental and Clinical Text", 9th Ed. 2005, Ch-13:339.
- McCaffrey C, Quamme GA. Effects of thyroid status on renal calcium and magnesium handling. Can J Comp Med 1984;48:51-57
- Deena Mendez I, Mamatha Kunder I, Shashidhar KN I, Lakshmaiah Venkataswamy 2 ; A comparative study of the ionic and total calcium levels in women with thyroid dysfunction. International Journal of Medical Science and Public Health | 2016 | Vol 5 | Issue 04)
- Beqic KS, Wagner B, Raber w, Schneider B, Hamwi A, Waldhausl W, Vierhapper H. Serum calcium in thyroid disease. Wiener klinische Wochenschrift. 2001; 113(1-2) 65-68.
- Sabuncu T, Aksoy N , Arikan E, Ugur B , Tasan E, Hatemi H. Early changes in parameters of bone and mineral metabolism during therapy for hyperthyroidism and hypothyroidism. Endocrine Research. 2001; 27(1-2) 201-213.
- Gammage MD and Logan SD. Effects of thyroid dysfunction on serum calcium in the rat .Clinical Science. 1986; 71(3) 271-276.
- Laura HM, Jeffrey SB. The Renal Manifestations of Thyroid Disease. J Am Soc Nephrol 2012; 23:22-26.
- Eriksen EF, Mosekilde L and Melsen F (1985). Trabecular bone remodelling and balance in hyperthyroidism. Bone 6(6) 421-428.
- Eriksen EF (1986). Normal and pathological remodelling of human trabecular bone -three dimensional reconstruction of remodelling sequence in normal and in metabolic bone disease. Endocrine Reviews 7(4) 379-408.
- Shivallela MB, Poornima RT and jayaprakash murthy DS. Serum calcium and phosphorus levels in thyroid dysfunction. Indian journal of fundamental and applied life sciences. 2012; 2(2):179-183.
- Bringhurst FR, Demay MB, Kronenberg HM (2003). Hormones and disorders of mineral metabolism. In: Williams's textbook of Endocrinology, 10th edn, edited by Larsen PR (WB Saunders publishers, Philadelphia) 1303-1372.
- B. Suneel, D.R. Nagendra, R.R. Aparna, D. Balakrishna, J.N. Naidu. Mineral Status in Thyroid Disorder (Hypo & Hyper). International journal of applied biology and pharmaceutical technology. 2011; 2(4): 423-429
- Christoph Schwarza, Alexander Benedikt Leichtle, Spiros A, Georg Martin F, Heins Z, Aristmenis K, Gregor L. Thyroid function and serum electrolytes . Swiss Medical Weekly. 2012; 13669 - 142.