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SERUM AND URINARY CALCIUM IN THYROTOXICOSIS IN RELATION WITH RENAL STONES

Jit Jiraratsatit. M.D., Cert. of Proficiency in Internal Med., Dr. Med.
Muni Keoplung, M.D.
Vachira Mokmol, M.D., Dr. Med.*

ABSTRACT

Thirty one cases of untreated thyrotoxicosis were studied with particular interest on serum and urinary calcium. The serum clacium of 26 cases of toxic diffuse goiter showed no difference from that of 5 cases of toxic multinodular goiter. There was no statistical difference either when the serum calcium of the whole toxic goiter group was compared with that of the control. Only one thyrotoxic patient had the serum calcium level higher than normal. The 24-hour urinary calcium in 8 thyrotoxic patients was 68.98 ± 24.97 mg. The overall result from these studies indicated that the thyrotoxic patients did not have hypercalcemia or hypercalciuria. In relation with renal stone, thyrotoxicosis of not long-enough duration is not a cause for renal stone formation.

One of the medical challenging problems is renal stone which is surprisingly common especially in the northern part of Thailand. All causes of renal stone formation are not clearly known, however, multiple factors are considered to involve. An important factor among these is hypercalcemia. This condition may be found in various disorders. Thyrotoxicosis is not uncommon in this part of the country and it is investigated whether it may be associated with hypercalcemia or hypercalciuria that, as a disease, may contribute to one of cause of renal stone particularly in this area.

* Department of Medicine, Faculty of Medicine, Chiang Mai University.

SUBJECTS AND METHOD

Thirty one cases of untreated thyrotoxicosis were studied. There were 27 females and 4 males ranging in age from 16 to 64 years. All of them had cardinal symptoms and signs of hyperthyroidism and were proved by total serum thyroxine of more than 6.6 ug% (by Ion-exchange column protein chromatography). At the time of physical examination, the thyroid glands were carefully palpated and their diffuse or nodular qualities were judged by palpation. By doing so there were 5 toxic multinodular goiters and 26 diffuse toxic goiters. The duration of their symptoms and signs of hyperthyroidism before attending our thyroid clinic varied from 1 month to 1 year.

Control group consisted of 6 females and 5 males with the age range of 19 to 46 years.

The morning serum calcium from all patients and controls was measured by EDTA-Calcein titration method. The total serum protein was measured by Biuret reaction and serum albumin by bromcresol green procedure. Twenty-four hour urinary calcium in 8 thyrotoxic patients was measured by EDTA-Calcein titration-Method.

RESULTS

Serum albumin and globulin

The results of the studies on serum albumin and globulin were shown in Table 1. The average serum albumin in thyrotoxic patients was 3.97 ± 0.71 Gm%. When it was compared with that of control (4.8 ± 0.27 Gm%) of the same age group which seemed higher, the difference was not statistically significant ($p > 0.05$). The serum values in toxic diffuse goiter and toxic multinodular goiter were almost similar. Clearly the globulin level was significantly higher in the thyrotoxic group than in the control (3.42 ± 0.88 Gm% and 1.78 ± 0.35 respectively; $p < 0.01$).

Table 1 Serum albumin and serum globulin

Subjects	Albumin Mean ± S.D.Gm%.	Globulin Mean ± S.D.Gm%	Numbers
Control	4.8 ± 0.27	1.78 ± 0.35	11
Toxic diffuse goiter	3.97 ± 0.64	3.53 ± 0.92	26
Toxic multinodular goiter	3.96 ± 0.99	2.83 ± 0.55	5
Whole toxic goiter	3.97 ± 0.71	3.42 ± 0.88	31

Serum calcium

In Table 2, values of serum calcium in various groups were summarized. The means of toxic diffuse goiter group and toxic multinodular goiter group were compared. Although the two means on averages were quite apart, there was no statistical difference ($p > 0.05$). There was only one thyrotoxic patient who had the serum calcium of 13 mg% and the other patients had the serum calcium not higher than 10.2 mg%. When the mean of the whole group of thyrotoxic patients was compared with that of the control, here again, it statistically showed no difference ($p > 0.05$)

Table 2 Serum calcium

Subjects	Calcium mg%	Numbers
Control	9.73 ± 0.28	11
Toxic diffuse goiter	9.51 ± 1.01	26
Toxic multinodular goiter	9.02 ± 0.54	5
Whole toxic goiter	9.42 ± 0.89	31

24-hour urinary calcium

Table 3 quantitatively showed the calcium in 24-hour urine in 8 thyrotoxic patients. The average was 68.98 ± 24.97 mg. No patient had the value over 150 mg.

Table 3 24-hour urinary calcium

Patients	Urinary calcium in mg.
1.	105.52
2.	100.70
3.	90.00
4.	68.40
5.	60.00
6.	44.55
7.	42.00
8.	40.70
Mean ± S.D.	68.98 ± 24.97

DISCUSSION

It has been postulated that the thyroid hormone releases bone calcium and subsequently results in skeletal demineralization, hypercalcemia and hypercalciuria[1,2,3,4]. In other views the negative balances of calcium in thyrotoxicosis result partly from an osteoporosis with release of calcium and perhaps in part from localized bone destruction of the osteitis fibrosa type but other possibilities have not been excluded[5]. In 1972, by using isotopic ^{45}calcium, Shaffer and Gregory showed that thyrotoxicosis is associated with decreased intestinal calcium

absorption that may contribute to the negative balance in the disease and it returned to normal after effective therapy [6]. Singhelakis et al meticulously proved this result [7]. Hypercalcemia has been reported in 3-22 percent of hyperthyroid patients [8, 9, 10,11]. From the authors's studies, the serum calcium in the thyrotoxic patients did not differ from that of normal. Only one patient had the serum calcium above normal (13mg%). As the serum albumin in both groups revealed no statistical difference, the binding of calcium with protein, mainly with albumin, should not interfere with such comparision of the serum calcium in both groups. Puppel and Curtis have indicated that patients with diffuse toxic goiter with exophthalmos appeared to lose more calcium than those with toxic adenomatous goiter [12]. From our studies both toxic diffuse goiter and toxic multinodular goiter showed no difference of serum calcium. One may imagine that the increased urinary calcium excretion may subsequently occur in order to keep serum calcium in normal level in thyrotoxic patients but it did not so appear accordingly to this studies. The 24-hour calcium in almost all patients was in normal range. Urinary calcium excretion of an unselected population range from 90 - 350 mg per 24 hours [13] and Sutherland found an increased urinary excretion of calcium in 60 per cent of patients with renal stone [14]. Howeveer, if a 24-hour urinary calcium excrition is less than 150 mg it is rarely a cause for stone formation in adult. Urinary calcium excretion of more than 150 mg per day is considered hypercalciuria and a potential factor in stone formation [15]. If it is based on this conclusion the thyrotoxic patients in these studies are not high urinary calcium excretors. Thyrotoxicosis, although a common disease, should not pay a significant role as a cause of nephrolithiasis. The duration of the appearance of symptoms and signs of thyrotoxicosis in the patients studied ranged from 1 month to 1 year. Undoubtedly the duration and severity of the disease are involved in the turnover of calcium. The hypercalcemia seen with some cases of hyperthyroidism ever reported is usually not of long-enough duration to result in renal calculous disease.

บทคัดย่อ

การตรวจหาระดับแคลเซี่ยมในเลือดและปัสสาวะในผู้ป่วยคอพอกเป็นพิษจำนวน 31 ราย พบว่าระดับแคลเซี่ยม ในเลือดในผู้ป่วยคอพอกเป็นพิษชนิด "ดิฟฟิวส" และชนิด "มัลตินอดูลาร" ไม่มีความแตกต่างกัน และเมื่อเปรียบเทียบระดับ แคลเซี่ยม ในเลือด ของผู้ป่วยคอพอกเป็นพิษทั้งหมดกับคนปกติ ก็ไม่พบว่ามี

ความแตกต่างกันทางสถิติเช่นเดียวกัน คงมีผู้ป่วยรายเดียวเท่านั้นที่มีระดับแคลเซี่ยมในเลือดสูงกว่าปกติ ส่วนปริมาณของแคลเซี่ยมในบัสสาวะของผู้ป่วยคอพอกเป็นพิษจำนวน 8 ราย เท่ากับ 68.98 ± 24.97 มก. จากการศึกษาครั้งนี้พบว่าระดับแคลเซี่ยมในผู้ป่วยคอพอกเป็นพิษไม่สูง และผู้ป่วยเหล่านี้ไม่ได้ขับแคลเซี่ยมออกทางบัสสาวะมากกว่าปกติ โรคคอพอกเป็นพิษที่เกิดขึ้นไม่นานไม่น่าจะเป็นสาเหตุที่ทำให้เกิดนิ่วในไต.

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