ASSOCIATION OF HYPERTHYROIDISM AND BLOOD GLUCOSE LEVELS IN PATIENTS ATTENDING ELOBIED HOSPITAL IN WESTERN SUDAN

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ABSTRACT

Objective: The objective of this study was to examine the effect of hyperthyroidism on blood glucose levels.
Materials and methods: Comparative descriptive study was done in twenty four patients with hyperthyroidism referred to Elobied hospital during May –July 2008, their ages ranged from 14 to 65 years; thirty three healthy volunteers with matching age and sex were included. Data collected through, clinical evaluation form, questionnaire, and laboratory investigations. Serum concentrations of total triiodothyronine (TT_3), total tetariodothyronine (TT_4) and thyroid stimulating hormone (TSH) were measured by enzyme linked immune sorbent assay (ELISA) and blood glucose concentrations (BGC) were measured by colorimetric method.
Results: The patients showed a concentration of TT4 more than 11.6µg/dl (higher than normal upper limit). The prevalence of glucose intolerance in hyperthyroid patients was 29.17% (n= 7). The glucose intolerance was significantly correlated with serum TT_4 levels (p=0.006, r=0.252).
Conclusion: Glucose intolerance is associated with high TT_4 levels in hyperthyroid patients.
Key words: Thyroid, goiter, hyperthyroidism, glucose tolerance, Western Sudan.

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الخلاصة

هدفت هذه الدراسة لمعرفه تأثير فرط نشاط الغدة الدرقية على معدل تركيز الجلوكوز في الدم.أجريت الدراسة في مستشفى مدينه الأبيض بغرب السودان على 24 مصاب بفرط نشاط الغدة الدرقية الغير خاضعين للعلاج، في الفتره من مايو –يوليو 2008 ،تراوحت أعمارهم بين 14-65 سنه مقارنه مع 33 أصحاء متطوعين كمجموعه ضبط. تم جمع المعلومات عن طريق التقييم السريرى والاستبيانات والاستقصاءات االمعمليه. تم قياس تركيز الثيروكسين وثلاثي ايوديدالثيروكسين والهرمون منشط الدرقية بطريقة قياس الإنزيم المناعي المرتبط وتركيزجلكوز الدم بطريقه قياس الطيف الضوئي اللونى.

خلصت هذه الدر اسه إلى أن عدم تحمل الجلكوز مرتبط بارتفاع تركيز هرمون الثيروكسين فى مرضى فرط نشاط الغدة الدرقيه.

INTRODUCTION

Hyperthyroid status defined as increase in TT_4 and TT_3 levels (1), caused due to: graves' disease (2), subacute thyroiditis, lymphocytic thyroiditis, postpartum thyroiditis (2), toxic multinodular goiter, solitary toxic adenoma, exogenously administered iodine and iodine containing drugs, excessive T_4 and T_3 ingestion, and TSH secreting pituitary tumor (3).

Hyperthyroid patients referred with signs and symptoms which include, heat intolerance, goiter, increase sweating, muscle weakness, tremor, rapid heartbeat, fatigue, weight loss, diarrhea, irritability and anxiety, exophathalums, menstrual irregularities and infertility (2).

Thyroid hormones stimulate almost all aspects of carbohydrate metabolism, rapid uptake of glucose by the cells with enhanced glycolysis (4), stimulate glycogenolysis and gluconeogenesis, they also promote glucose absorption in the intestine and degradation of insulin, and increase peripheral glucose utilization (5). The pancreatic beta and alpha cells secretary function is impaired due to increase thyroid hormone secretion (6). All these effects probably result from the overall increase in cellular metabolic enzymes caused by thyroid hormones (4). This may indicate that thyroid hormones are diabetogenic (5). Data suggested that subclinical hypothyroidism is associated with an increased risk of symptomatic hypoglycemia (7), while hyperthyroidism leads to glucose intolerance (8). The diagnosis of glucose intolerance is made on the basis of blood glucose concentration either alone or in response to an oral glucose load (3).

In hyperthyroid patients the prevalence of glucose intolerance and clinical diabetes are increased, and control of pre-existing diabetes is impaired. This impairment of glucose tolerance has been attributed to reduced insulin sensitivity , particularly at the level of the liver , enhanced basal hepatic glucose production and reduced insulin secretion (9, 10)

MATERIALS AND METHODS

This is comparative descriptive – study done on 24 untreated thyroid patients (22 females and 2 males, age range 14-65 years), 33 healthy volunteers with matching age and sex (30 females, 3 males) were included as a control group. Patients were referred to Elobied hospital Western Sudan during May– July 2008. Five mls of blood were collected from study subjects to measure TT_3, TT_4, and TSH using sandwich ELISA methods (11) using human kits.

One ml of blood was taken in fluoride container from patients and control at intervals of 0 (fasting), 60, 90 and 120 min, separated plasma used for oral glucose tolerance test (OGTT) (12), by glucose liquizyme kit. Values were presented as mean ± standard deviation (SD) of all measured variables. The t-test, one way ANOVA and partial correlation coefficient were used to assess the associations between variables in the study groups. Data were analyzed using Statistical Package for Social Sciences (SPSS) computer program (version11) and P values ≤ 0.05 were considered to be statistically significant.

RESULTS

Comparing TT_4, TT_3 and TSH of all patients (n= 24) with that of control group(n= 33), we observed a significant increase in TT_4 and TT_3 levels in patients group and significant decrease in TSH levels as

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shown in Table (1).

The values of blood glucose concentrations at 0 (fasting), 60, 90 and 120 min were significantly higher in seven patients that showed glucose intolerances. In the other patients, their glucose tolerances still remained normal in comparison with mean values of the controls (Table (2) and Fig. (1)).

There was no difference observed between TT_4, TT_3 and TSH levels in patients with normal and abnormal glucose tolerance. In order to clarify the relationship of glucose tolerance and serum thyroid hormones, correlation between the levels of TT_4, TT_3 and TSH and blood glucose was determined. Serum TT_4 values showed a significant positive correlation ($r=0.252$, $P= 0.006$) with 120min blood glucose concentrations. While TT3 and TSH were correlated positively ($r = 0.166$, $r = 0.164$ respectively) with blood glucose concentrations but the results were not significant.

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Table (1.1): The T4, T3 and TSH total (mean±SD) levels among study subjects and control:

Parameter	TT_4 µ g/dl (mean±SD)	TT_3ng/ml (mean±SD)	TSH miu/l (mean±SD)
Control	6.85±1.11	1.29±1.18	1.35±1.34
All patients	16.97±5.76	4.74±4.06	0.26±0.45
p. value	0.00	0.00	0.00

Table (1.2): The TT_4, TT_3 and TSH total (mean±SD) levels among study subjects

Parameter	**TT_4 µ g/dl (mean±SD)**	**TT_3ng/ml (mean±SD)**	**TSH miu/l (mean±SD)**
Patients with normal glucose tolerance	16.68±6.14	4.73±4.60	0.33±0.53
Patients with abnormal glucose tolerance	17.7±5.12	6.23±3.62	0.11±0.12
P. value	**0.00**	**0.00**	**0.00**

Table (2) Mean blood glucose concentration among study subjects during oral glucose tolerance test:

Parameters	**Fast BGC (mean ± SD) mmol/l**	**1h BGC (mean ± SD) mmol/l**	**1.5h BGC (mean ± SD) mmol/l**	**2h BGC (mean ± SD) mmol/l**
Control No. (33)	4.50±0.53	6.38±1.17	5.78±0.85	4.94±0.53
Patients with normal blood glucose No. (17)	4.22±0.62	6.36±1.44	5.88±1.0	5.45±0.86
Patients with abnormal blood glucose No. (7)	*7.17±1.72	*15.00±5.42	*14.60±4.08	*14.92±4.04

* $p < 0.05$ significant.

Serum total T_4 value correlated positively (r=0.252) with significant result (p=0.006) with 2 hours blood glucose concentration, TT3 and TSH correlated positively (r = 0.166), (r = 0.164) with blood sugar concentration but showed no significant results (p>0.05) respectively. Data were analyzed by chi-square and co-efficiency correlation.

DISCUSSION

Seven patients (29.2%) had glucose intolerance this agree with (8, 9, 6, 10) they found that; thyroid hormones had early effect in glucoregulatory hormones, glucagon and growth hormone. The increase in T_4 level had hyperglycemic effect, high T_4 blood level lead to increase of T_3 blood level which may lead to thyrotoxicosis.

Thyrotoxicosis does not alter in growth hormone secretion, whereas plasma glucagon is appropriately suppressed by increased plasma glucose level, growth hormone not glucagon may contribute to early hyperglycemic effect (10). Twenty nine point two percent out of total hyperthyroidism had glucose intolerance; this may be due to types of hyperthyroidism that affect the patients.

Depending on normal range of blood glucose concentration total mean±SD was varied between study groups during OGTT:

Abnormal blood glucose concentrations (Fasting 1, 1.5 and 2 hour(s)) showed among 29.2% hyperthyroidism, because elevated T_4 levels lead to increase glucose absorption (5)

Hyperthyroidism can unmask diabetes because glucose levels can be abnormally elevated due to increase insulin resistance (11).

This study showed that, hyperthyroidism were glucose intolerance had blood glucose concentration higher than blood glucose concentration in control group, this result agree with (8, 10) they found that, these group

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in tolerated blood glucose because their growth hormone concentration not affected by increase blood glucose concentration in this group.

In the present study a significant positive correlation (r=0.252,p=0.006) was founded between serum T4 level and blood glucose concentration this agrees with (9) who found that T4 was significantly correlated (r=0.081) , (p<0.05) with blood glucose concentration.

CONCLUSION

The findings showed significance strong positive correlation relationship between serum T_4 level and blood glucose concentration. Glucose intolerance was more common in hyperthyroidism among age group >20 years.

RECOMMENDATION

This is the first study to be carried out in the Sudan to determine the association of hyperthyroidism and blood glucose levels.

Diabetic People should be tested for thyroid disorders.

There is a need for further research directed toward the acquisition of more detailed data on the hyperthyroidism that cause the glucose intolerance and determine the affected group to assess problem size in this area.

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