Study of hematological changes and hypertension in patients with hyperthyroidism

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Abstract

Hematological abnormalities, have been described in hyperthyroidism. There is interaction among hypothalamus gland , pituitary gland and thyroid gland system in regulation of metabolic and function of body, this achieved by balance between hormonal stimulation with drawl of other hormone by feed back mechanism, any changes in this hormonal balance lead to thyroid gland disorders, the present study was carried out to evaluate the effect of hyperthyroidism on some physiological blood properties is Hb ,WBC ,RBC ,blood pressure ,determination the concentration of thyroid hormones (T3, T4, TSH) for patients ( N=30) which compared with control group (N=30) . The following finding were obtained :
1- Significant decrease (P< 0.05 ) in RBC patients compared with control group.
2- Significant elevation (P<0.05 ) of (T3 , T4 ) concentration and reduction of (TSH) concentration for patients group compared with control group .
3- Significant decrease (P< 0.05 ) in Hb concentration for study group compared with control group.
4- Significant decrease (P< 0.05 ) in WBC patients compared with control group.
5- Significant elevation (P< 0.05 ) in blood pressure patients compared with control group.

Introduction

Thyroid gland is one of the largest glands in the body weight (g20-15) and brown red shaped like a butterfly which consists of two lobes are located in front of the throat on both sides of the trachea and connected by the isthmus extended over the front surface of the trachea, and the gland is the ability to store their secretions the amount is greater than any endocrine gland, and despite its small size , but it represents the basis for the generation of energy in the body, but it can be said that it controls the functions of the body as a whole (Mader and Sylria, 2001) physiological the thyroid norepinephrine that controls the metabolism of cells, which is a hormone Althaioxin (T4 ) Thyroxin hormone three wishes Althaaronen (T3) Triiodothyronine and calcitonin (Calcitonine) (approximately 80%) of T4 converts to T3 by the user peripheral such as the liver, spleen and kidney and the T3 more effective than T4 to affect the growth and the speed and function of the number of the organs in the body either calcitonin, it plays a role in the balance of calcium in the body's internal environment ( رمضان, 1993).The most obvious feature of the thyroid gland is its ability to focus large amounts (Iodine) that the amount of iodine in the thyroid perhaps up to 50 or several hundred times largest compared in the blood plasma. And the fact that iodine is the main thyroid hormone molecule therefore not be able to gland hormones
without making an adequate amount of iodine in the blood. During the period of iodine deficiency, the pituitary gland secretes excessive amounts of the hormone catalyst for thyroid TSH, which leads to increased production of epithelial cell secretory and thus gets inflated hypertrophy of the cells thyroid that is, they increase in size and growing division filamentous of these cells or happen hyperplasia and then grow gland attempt bridging the decline in the concentration of hormones from this gland and increases the blood vessels as well as increase the weight of the thyroid gland in general the term goiter on different types of enlarged thyroid, and these changes formalism refers to the increased activity of the gland excitation and is known as the hormone catalyst for thyroid TSH which is secreted by the anterior lobe of the pituitary gland (Hoang, et al., 1996) and if the concentration of the pituitary did not succeed in return gland to normal level, the gland intervention phase stress putting thyroid infection, and that the cell secretory of the thyroid gland at least height and shatter some of the cells and infected gland atrophied atrophy when available iodine in sufficient quantities at least stimulate the pituitary gland (Turner and Bagnara, 1976) so the hormone TSH organization and functions of the thyroid gland by stimulating inventory iodine and manufacture of hormones, thyroid, and free T3, T4 to the circulatory system, and is controlled secretion of TSH -mediated hormone -induced thyroid (TRH) Thyrotrophin Releasing Hormone secreted from the gland, the hypothalamus and the organization and function of the thyroid gland include both mechanical nutrition retro negative Feed Back Mechanism or hardware organization self- Auto- Regulatory Systems as the amount of hormones the thyroid in gyro -controlled the degree of stimulation of Thyrotropin through mechanical feeding reactionary (TSH associated inversely concentration of hormone free in the blood) and the amount of the hormone linked in balance with hormone free, and either control self-regulatory it means that the concentration of iodide higher inside the thyroid reduces liberated iodide thyroid to the rotation as well as migration(Keele and Neil, 1973; Ganong, 1991; Smerdely, et al. 1993)

Thyroid hormones (TSH) play an important physiological role in humans. TSH may regulate human hematopoiesis in the bone marrow [Golde, et el 977]. The association of thyroid disorders and abnormalities in hematological parameters is well known. In 1979, Fein showed that Graves’ disease is associated with anemia [Fein and Rivlin,1975]. Horton observed a decreased number of red blood cells (RBCs) in the peripheral blood (PB) of patients after thyroidectomy [Horton1976]. Hyperthyroidism can cause certain forms of anemia on the one hand or hyperproliferation of immature erythroid progenitors on the other hand. The anemia is usually macrocytic hypochromic anemia of moderate severity Chronic blood loss in thyrotoxicosis may cause hypochromic anemia. Megaloblastic anemia is associated with folate consumption or pernicious anemia [Horton1976] which seen 3% of cases of thyrotoxicosis (Fein and Rivlin,1975). The decreased red cell survival or abnormal iron utilization may contribute anemia (Golde, et el 977)

It has been found that all hematological parameters return to normal when a euthyroid state is achieved [Perlman and Sternthal,1983]. As far as white blood cells are concerned, a slightly depressed total leucocyte count, neutropaenia, have been observed in hyperthyroid patients [Golde, et el 977]. Furthermore, normal, or slightly decreed total leucocyte counts have been found in hyperthyroid patients, with only a relative decrease in the number of neutrophils.

Data about the white blood cell count is contradictory, neutropenia and at least relative lymphocytosis are seen in 10% of the cases with thyrotoxicosis
Golde, et al. found clear increase in lymphocytes, Kocher found relative or absolute lymphocytosis with relative neutropenia which was named Kocher's blood picture (Corrocher 1981). These findings were confirmed in two large series but De Quervain found that these findings were not different from controls (Corrocher 1981). Hypertension is the most common form of hyperthyroidism. Hyperthyroidism increases systolic blood pressure by decreasing systemic vascular resistance, increasing heart rate, and raising cardiac output. Potential cardiovascular consequences of hyperthyroidism include atrial arrhythmias (especially atrial fibrillation), pulmonary hypertension, left ventricular hypertrophy, and heart failure. The prevalence of hypertension is greater among hyperthyroid patients than euthyroid patients. Whether there is a blunted nocturnal decline in ambulatory blood pressure among hyperthyroid patients is more controversial (Franklin, 2001).

**MATERIALS AND METHODS**

This research was carried out at Babylon Hospitals. This was a retrospective study in which all randomly patients with hyperthyroidism and at the period between 10/2/2013 and 10/8/2013 were included. Patients group were 30 samples and control group were 30 samples.

1- **Thyroid Hormone Measurements**

Triiodothyronine hormone (T3), thyroxin hormone (T4), and thyroid stimulating hormone (TSH) levels were measured using Enzyme Linked Immunosorbent Assay (ELISA) for quantitative determination of hormones concentration in human serum/plasma using the methods of Helenius [Helenius and 1986Tikanoja,]. Whole blood samples were collected through venipuncture, centrifuged at 3000 rpm, and then frozen at −20°C for storage if to be measured later.

2- **Determination of Hematological Profile**

Hemoglobin concentration was determined by a colorimetric method with the addition of a sample centrifugation (1,600 ×g, 5 min) before reading. Erythrocytes (red blood cells) was counted simultaneously in a Neubauer chamber [Campbell, 2004]. The leukocyte count (white blood cells (WBCs) was obtained through the counting of these cells in a Neubauer chamber using heparinized blood. Because heparin causes leukocyte destruction in ostrich blood [Green and McLendon, 2000]

3- **measurement of blood presser by using sphygmomanometer to measuring the blood pressure to control and patients group.**

**Statistical Analysis**

Results were analyzed using SPS test student T-Test in Excel system where the rate is extracted ± standard deviation (SD) and compared the results between patients and the control group below the level of probability of P < 0.05.

**Results and discussion**

The results of this study for the increase of value P < 0.05 in the concentration of the hormone T4 hormone, T3 for a satisfactory compared with the control group, while
there was a decrease value <0.05 in the concentration of the hormone TSH as in (Table - 1)

Figure (1) illustrates the changes among T4, T3 and TSH in patients’ compared with control group

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Hyperthyroid group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4 (mmol/L)</td>
<td>8.8 ± 0.96</td>
<td>6.3 ± 0.79</td>
</tr>
<tr>
<td>T3 (nmol/L)</td>
<td>1.1 ± 0.25</td>
<td>0.51 ± 0.15</td>
</tr>
<tr>
<td>TSH (MU/L)</td>
<td>2.3 ± 0.73</td>
<td>2.8 ± 0.98</td>
</tr>
</tbody>
</table>

Represents the average value mean ± standard deviation
* A significant difference at the level of probability P < 0.05

Mean Hemoglobin (HB), mean RED BLOOD CELL (RBC) and white blood cell (WBC) levels in the hyperthyroid patients were significantly different from their control groups, these values were significantly (p < 0.05) decreased, compared to their control group (Table 2).

Table 2: Results of the RED blood cell , WBC and Hb variables concentration (mean ± SE) in hyperthyroid patients and control group

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Hyperthyroid group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hb (g/dL)</td>
<td>8.6 ± 1.3 (No. = 30)</td>
<td>11.5 ± 1.2 (No. = 30)</td>
</tr>
<tr>
<td>RBC (million/mm3)</td>
<td>4.5 ± 0.34 (No. = 30)</td>
<td>5.2 ± 0.72 (No. = 30)</td>
</tr>
<tr>
<td>WBC (million/mm3)</td>
<td>4.8 ± 0.5 (No. = 30)</td>
<td>6.7 ± 0.8 (No. = 30)</td>
</tr>
</tbody>
</table>

Student t test was used to compare each test group with its control group
P < 0.05
Mean high blood pressure (BP) is in the hyperthyroid were significantly different from their control groups, these values were significantly (p < 0.05) increased compared to their control group (Table 2).

Table 3: Results of the blood pressure measurement (mean ± SE) in hyperthyroid patients and control group
Quantity | Hyperthyroid group | Control group |
--- | --- | --- |
High blood pressure | 14 ± 0.78 (NO = 30) | 11.9 ± 0.7 (NO = 30) |
Low blood pressure | 8.90 ± 0.49 (N = 0) | 8.11 ± 0.7 (N = 30) |

Student t test was used to compare each test group with its control group

P < 0.05

**DISCUSSION**

The results of this study show an increase of value P < 0.05 in the concentration of the hormone Althairoxin T4 hormone T3 for a compared with the control group, while there was a decrease value P < 0.05 in the concentration of the hormone TSH as in (Table -1) Has attributed the cause to get the case in the thyroid gland Hyperthyroidism or Thyrotoxicosis and cause inflation resulting from the decline direct in the rate of taking iodine inorganic or it may be caused as a result of an autoimmune disease which is called the disease Graves disease (the production of antibodies to the recipients hormone-induced thyroid), instigator of the thyroid hormone responsible for the activation of many proteins and thus stimulates Systems response and final outcome of the process of transmission of signals in the thyroid gland are alarm for making thyroid hormone so any defect in this immune response leads to disorder in the secretion of thyroid hormone (Andreas, 1999) and as the disease goiter a result of iodine deficiency causes enlargement of the thyroid gland result for the case hyperplasia hyperplastic Goiter (Zao, et al. 1998) and has been observed inflation and clearly at the top of the neck for women with this disease, (Nguyen, 1993).

As far as the white blood cells and red blood cells count reduction are concerned, this shows that the bone marrow is depressed and that thyroid hormones play an important role in the regulation of the human hematopoiesis in the bone marrow. This fact has also been shown to be evident in other studies [Rivlin, 1975]. With regard to white blood cells, triiodothyronine (T3) hormone has been proven to be a prerequisite for normal B-cell production in the bone marrow through its regulation of pro-B-cell proliferation [foster, 1999]. The hemoglobin level of the subjects suffering from immunological thyroid was low too. This clinically indicates a state of anemia. Other studies have also shown that hyperthyroidism causes anemia or hyperproliferation of immature erythroid progenitors, and the anemia is usually macrocytic hypochromic anaemia [Horton, 1976]. The increase in the blood pressure can be attributed to the imbalance in the increases systolic blood pressure by decreasing systemic vascular resistance, increasing heart rate, and raising cardiac output. Potential cardiovascular consequences of hyperthyroidism include atrial arrhythmias (especially atrial fibrillation), pulmonary hypertension, left ventricular hypertrophy, and heart failure. The prevalence of hypertension is greater among hyperthyroid patients than euthyroid patients. Whether there is a blunted nocturnal decline in ambulatory blood pressure among hyperthyroid patients is more controversial. (Franklin, 2001)
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الخلاصة

التغييرات النموية التي تشاهد لمرضى فرت نشاط الغدة الدرقية تتشتت بها هرمونات الغدة تحت المهاد – الغدة النخامية – الغدة الدرقية في تنظيم الوظيفة الحيوية للجسم عن طريق تحفيز بعض الهرمونات وimetype الأخرى بواسطة ميكانيكية التغذية الاستجعاعية وإذ حدوث أي خلل في هذا التوازن الهرموني يؤدي إلى الإصابة بمرض تضخم الغدة الدرقية. والدراسة الحالية التي تضمنت دراسة تأثير فرت نشاط الغدة الدرقية على بعض التغيرات الفسيولوجية قد شملت قياس تركيز خصاب الدم وعدد كريات الدم البيض وعدد كريات الدم الحمر وضغط الدم وهرمونات الهرمونات (T4, T3, TSH, TSH) إذ تم فحص عينات الدم ل(30) مريضة من النساء اللواتي قد أصيبن بمرض تضخم الدرقية ثم تم مقارنة النتائج مع مجموعة السيطرة والتي تضمنت 30 امرأة سليمة، وظهرت النتائج الدراسة ما يأتي:

P<0.05 (1-انخفاض معنوي)
2- ارتفاع معنوي (0.05 < P) في معدل تركيز هرمون T3، T4، TSH ومعالجة المصابات مقارنة مع مجموعة السيطرة.

3- حصول انخفاض معنوي (0.05 < P) في معدل تركيز الليمودين فيgres في مرضى فرط نشاط الغدد الدرقية مقارنة مع مجموعة السيطرة.

4- انخفاض معنوي (0.05 < P) في عدد كريات الدم البيضاء لمرضى فرط نشاط الغدد الدرقية مقارنة مع مجموعة السيطرة.

5- ارتفاع معنوي (0.05 < P) في معدل ضغط الدم الشرياني لمرضى فرط نشاط الغدد الدرقية مقارنة مع مجموعة السيطرة.