Research article

Assessing the complete blood count in Graves' ophthalmopathy patients treated with RAI-131 in Iraq

Zena A. Khalaf[1], Furqan Majid Khadhem[2], Marwah Sabah Altaiee[3], Iman I. AL-Sheakli[4]

[1,2]Department of Optics Techniques, Al-Farabi University College, Al-Dora, Baghdad, Iraq
[3]Department of Chemistry, College of Education for Pure Science (Ibn Al-Hatham), University of Baghdad, Iraq
[4]Department of Orthodontics, College of Dentistry, University of AL-Farahidi, Baghdad, Iraq

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Corresponding author: **Zena A. Khalaf.** Email: zena.shujairi@gmail.com

ABSTRACT

Introduction and Aim: Graves ophthalmopathy is one of the pandemic public health disorders in Iraq. The current investigation attempts to determine the variation in the complete total blood cells on the recovery of individuals with Graves' ophthalmopathy following low and high-dose Radioactive Iodine 131 (RI-131) exposures.

Materials and Methods: The complete blood CBC level in people with Graves' illness and healthy, normal controls were quantitatively identified using the CBC counter. Thyroid stimulating hormone was utilized to compare the recovery of ophthalmopathy patients in comparison to a control group.

Results: In comparison to healthy controls, patients with Graves' ophthalmopathy disease who received 10 mci of RAI-131 had elevated lymphocyte counts ($P<0.01$). After one year of therapy with antithyroid drugs, lymphocyte counts rose significantly ($P<0.01$). In contrast, patients treated with 10 mci of RAI-131 experienced a dramatic reduction in monocytes ($P< 0.01$) over the course of four months. Lymphocytes, monocytes, and platelets were significantly lower in patients with ophthalmopathy after one month of therapy with 20 mci of RAI-131 compared to controls. No significant difference in red blood cells and hemoglobin levels before and after treatment with low and high doses of RAI-131 was observed.

Conclusion: Assessment of lymphocytes, monocytes, granulocytes, and platelets levels in Graves' ophthalmopathy disease patients (GD ophthalmopathy) could be used as an effective diagnostic marker for determining the most effective dose for Graves' ophthalmopathy disease treatment.

Keywords: Complete blood count; thyroid-stimulating hormone; Graves ophthalmopathy; thyroid eye disease; radioactive iodine 131.

INTRODUCTION

Ophthalmopathy illness, also known as Graves's orbitopathy, is a sight-threatening eye condition that has puzzled scientists and clinicians for decades (1, 2). Thyroid-associated Graves' ophthalmopathy, also known as hyperthyroid ophthalmopathy, is an autoimmune eye illness that affects the eyes of people who are euthyroid or hypothyroid and who have a history of hyperthyroidism due to Graves' disease (3, 4).

Thyroid-stimulating hormone (TSH) is an important hormone in the hypothalamus-pituitary-thyroid axis. Blood cell formation and metabolism are both greatly aided by thyroid stimulating hormones. Anemia, thrombocytopenia, leukopenia, erythrocytosis, pancytopenia, and change in red blood cell counts are among the few effects that thyroid malfunction in blood cells can produce (5). There is much experimental study being conducted on the effects of thyroid stimulating hormones on Graves' ophthalmopathy.

Radioactive iodine (RAI), also called RAI-131 has been widely used in the effective treatment of thyrotoxicosis caused by Graves' disease (6). RAI-131 is administered either in a capsule of liquid form with dose depending on the thyroid parameters. In general, a fixed dose regimen ranging from 10-25 mci of radioactive iodine-131 is used in preventing hypothyroidism. Although RAI-131 is effective in achieving treatment goals, these ionizing radiations have also been known to bring about adverse mild-severe effects (7,8).

In humans, body radiation therapies have been shown to impact hematopoiesis and complete blood counts (9). Therefore, the objective of this study was to assess the hematological status of individuals having Radioiodine I-131 therapy for Graves' ophthalmopathy.

MATERIALS AND METHODS

Subjects

This study comprised 50 ophthalmopathy patients and 20 normal healthy persons. The ages of the women who participated in the research ranged from 20 to 71. Ophthalmopathy was the clinical diagnosis made between January and March 2022 at the Baghdad Centre for Radiotherapy and Nuclear Medicine Hospital.

Patients with ophthalmopathy and healthy controls both provided blood samples. Ophthalmopathy causes, thyroid sizes, and radiation exposures were recorded in

patients. Patients on RAI-131 treatment were followed up 1 and 3 months after treatment.

Study groups

The participants enrolled in the investigation were classified into group 1 (n=50) which included ophthalmopathy patients treated with RAI-131. Group 1 was further divided into two subgroups based on the RAI-131 received. In Group 1A the ophthalmopathy patients were treated with a dose of 10 mci RAI-13I, while Group 1B included patients treated with RAI-131 dose of 20 mci. After receiving RAI-131 treatment, these patients were observed one and three months later. Group 2 was composed of 20 healthy individuals (controls). The Al-Rusafa district of the Health Ministry in the Governorate of Baghdad gave their clearance for this study to be conducted. From each individual in the groups, two blood samples were obtained; a 2 ml uncoagulated blood sample was retrieved for analysis, and a full blood sample was EDTA-anticoagulated for a complete blood count.

Evaluation of serum TSH concentration

TSH concentrations in serum were measured using a commercial ELlSA kit (Biotech, Korea). The minimal limits were 0.05 m/dl for TSH (10).

Complete blood count

All samples were kept at room temperature for six hours before being examined. The obtained blood samples were well mixed before being placed into CBC count equipment for analysis of CBC parameters. A calibrated automated hematology analyzer was used to measure hemocytometer parameters (Samsung Labgeo HC10, Korea). The automated hematology analyzer measures white blood cell count (WBC), lymphocyte, granulocyte, and monocyte percentage, red blood cell count (RBC), hemoglobin concentration (Hb), and platelet count (PLT) (11).

Statistical analysis

The data was then presented in the form of mean SD. The SPSS (20I9) program from the Statistical Analysis System was used for the statistical analysis. The t-test was used to examine the study's parameters, and statistical significance was set at P≤ 0.05.

RESULTS

Impact of RAI-131 doses (10 mci and 20 mci) on hematological parameters in GD Ophthalmopathy

The study investigated the level of TSH and the correlation with CBC in Ophthalmopathy patients treated with radioactive iodine (10 mci and 20 mci) compared with normal healthy controls. Results for the hematological parameters at RAI-131 doses 10 and 20 mci are presented in Tables 1 and 2 respectively. At a lower radiation dose (10 mci) a significant increase (P≤ 0. 01) in TSH levels was seen after one and three months of treatment. No- considerable differences in the levels of WBC, RBC, HB, and platelets were seen before and after treatment with a low dose of radioactive iodine (10 mci) compared to healthy controls (Table 1).

In contrast, Table 1 shows that RAI-131 (10 mci) treatment for ophthalmopathy leads to a very significant change in lymphocyte and monocyte levels (P≤ 0.01) and a substantial difference in granulocytes levels (P≤ 0.05). Before and after treatment with radioactive iodine (10 mci), patients with ophthalmopathy had significantly (P≤ 0.01) decreased granulocyte counts compared to controls. Despite the statistically significant differences (P≤ 0.01) between patient groups, lymphocyte and monocyte levels remained normal.

Table 1: Impact of RAI-131 dose 10 mci on hematological parameters in ophthalmopathy patients and healthy controls

Group 1A	**Parameters (Mean ± SE)**							
	Dose 10							
	WBC	**Lymphocyte**	**Monocyte**	**Granulocyte**	**RBC**	**Hb**	**Platelets**	**TSH**
Initial levels in patients	7.63 ± 0.47^{a}	35.42 ± 1.97^{a}	8.60 ± 1.39^{ab}	51.12 ± 4.32^{bc}	4.64 ± 0.14^{a}	13.45 ± 0.41^{a}	268.78 ± 16.77^{a}	0.05^{a}
After one month	7.04 ± 0.46^{a}	28.84 ± 3.42^{b}	10.61 ± 1.82^{a}	52.69 ± 4.92^{bc}	4.56 ± 0.15^{a}	12.90 ± 0.52^{a}	263.58 ± 22.77^{a}	2.5^{b}
After three months	7.08 ± 0.48^{a}	33.89 ± 4.02^{ab}	10.23 ± 1.58^{ab}	49.90 ± 6.04^{c}	4.52 ± 0.17^{a}	12.51 ± 0.51^{a}	296.37 ± 35.25^{a}	5.3^{c}
Control (Normal healthy)	7.25 ± 0.31^{a}	30.51 ± 1.62^{ab}	10.93 ± 1.01^{a}	60.72 ± 1.95^{ab}	4.62 ± 0.13^{a}	12.72 ± 0.43^{a}	268.52 ± 12.44^{a}	1.5^{b}
LSD value	1.257 NS	6.026*	3.115*	9.638**	0.372 NS	1.303 NS	47.995 NS	3.37**

Superscript differences indicate statistically significant distinctions between groups.
** mean statistically significant (P≤0.01), * means significant (P≤ 0.05).

Table 2: Effect of RAI-131 dose (20 mci) on hematological parameters in ophthalmopathy patients and healthy controls

Group 1B	**Parameters (Mean ± SE)**							
	Dose 20							
	WBC	**Lymphocyte**	**Monocyte**	**Granulocyte**	**RBC**	**Hb**	**Platelets**	**TSH**
Initial levels in patients	6.58 ± 0.95[a]	27.84 ± 1.06 [a]	5.96 ± 1.21 c	62.64 ± 3.26 [a]	4.66 ± 0.19 [a]	12.84 ± 0.46 [a]	273.0±18.04 [a]	0.05[a]
After one month	6.31 ± 1.34 [a]	18.45 ± 3.18 [b]	11.30 ± 1.84 [a]	67.92 ± 4.45 [a]	4.67 ± 0.21[a]	12.45 ± 0.49 [a]	209.50 ± 11.78[b]	1.4[b]
After three months	6.87 ± 1.39 [a]	24.00 ± 3.91 [ab]	10.50 ± 1.32[ab]	68.50 ± 3.12[a]	4.64 ± 0.15[a]	12.60 ± 0.51 [a]	222.00 ± 11.90[ab]	4.3[c]
Control (Healthy)	7.26 ± 0.31[a]	30.51 ± 1.61 [a]	10.93 ± 1.01 [a]	60.72 ± 1.95[a]	4.62 ± 0.13	12.72 ± 0.43 [a]	268.52 ±12.44 [a]	1.5[b]
LSD value	2.195 NS	7.353 **	3.452 **	8.856 NS	0.522 NS	2.059 NS	54.43 **	3.371**

Superscript differences indicate statistically significant distinctions between groups
**Statistically significant (P≤ 0.01), *Significant (P≤ 0.05).

TSH levels in individuals with ophthalmopathy illness who received a high dosage of RAI-131 (20 mCi) showed a statistically significant (P≤ 0.01) rise from baseline values at one and three months post-treatment (Table 2). Results also showed no-significant effect of WBC, granulocytes, RBC, and HB on ophthalmopathy patients before and after treatments of radioactive iodine (Table 2). Patients with ophthalmopathy who were given radioactive iodine (20 mci) had significantly higher numbers of lymphocytes, monocytes, and platelets compared to the healthy control group (P≤ 0.01). In ophthalmopathy patients, the maximum level of platelets was 273 before therapy with radioactive iodine (20 mci), whereas the maximum level of granulocytes was 68.5 after three months of treatment with RAI-131 (20 mci).

The effect of RAI-131 doses (10 mci and 20 mci) on complete blood counts (CBC) in ophthalmopathy

The CBC levels in GD ophthalmopathy patients' were examined in order to ascertain the optimal RAI-131 dose for treatment as well as identifying the effects of radiation on CBC. Tables 1 and 2 show that there is a substantial difference in lymphocyte and monocyte levels following treatment with a low and high dosage of RAI-131 in individuals with ophthalmopathy. Results showed that a low dose affected granulocyte levels before and after treatment with RAI-131. A significant difference in platelet levels before and after treatment in ophthalmopathy patients was observed with a high dose of RAI-131. On the other hand, there are no significant differences in WBC, RBC, and HB in ophthalmopathy patients before and after treatment with both doses of RAI-131.

DISCUSSION

In this present study, non-significant differences were seen in the levels of WBC, RBC, HB, and Platelets in grave ophthalmopathy disease patients before and after treatment with a low (10 mci) dose of radioactive iodine. Our findings contradict lmam's (12) findings that Graves' illness is linked with normocytic anemia and a low to somewhat low total WBC count.

The minimum level of Granulocytes was seen to reach 49.0 in Ophthalmopathy patients after three months of treatment with RAI-131 (10 mci), while a previous study showed the relative lymphocytosis and monocytosis to be below-normal with a slightly depressed platelet count (12). The CBC count and other bodily processes are among those severely impacted by untreated hyperthyroidism. After hyperthyroidism treatment, most bodily functions, including thyroid hormone levels, return to normal. Total white blood cell (WBC) counts can drop when thyroid hormone levels are elevated, with neutrophil counts dropping the most. People with extremely low neutrophil counts are more likely to develop severe hyperthyroidism (13, 14).

The risk of having low MCHC was 6.84 times higher and the risk of developing low neutrophil was 9.69 times higher in people exposed to radiation compared to those who were not (15). Infections may develop after radiation therapy lowers the number of lymphocytes and granulocytes in circulation. Additionally, anemia can be brought on by exposure to radiation over time. Hematological problems are susceptible to the cumulative effects of ionizing radiation (16-19). In this study, the relationship between CBC and hyperthyroidism showed that granulocytes levels were most affected by RAI-131.

A maximum increase in platelets was 273 in ophthalmopathy patients before treatments with radioactive iodine (20 mci) while it showed that the maximum level of granulocytes was 68.5 after three months of treatment with RAI-131 (20 mci). The hematological effects of RAI-131 exposure have received little attention. However, Yoshihara *et al.* found that patients with Graves' disease had no significant difference in hematological markers when compared to those who weren't suffering from the disease (20). According to reports, untreated

hyperthyroidism patients had a significant decrease in white blood cell counts (20, 21).

When ophthalmopathy patients were evaluated before and after treatment with a high dose of RAI-131, the results demonstrated a significant difference in their platelet count. On the other hand, there was no significant differences in WBC, RBC, and HB in ophthalmopathy patients before and after treatment with both the doses of RAI-131. While Dorgalaleh *et al.,* (5) stated that anemia is not common in hyperthyroid individuals, it did find that hemoglobin, white blood cell count, and platelet count are all connected to thyroid disease, but these alterations return to normal if a euthyroid (normal) condition is achieved (8, 21). There were non-significant changes in the WBCs count, RBCs count, and platelets. Mild anemia (low Hb) before hyperthyroidism therapy was considerably improved after treatment. It has been observed that the only major hematologic alteration in individuals with Graves ophthalmopathy disease was moderate anemia, which improved once the thyroid sickness was treated (21).

CONCLUSION

ln conclusion close monitoring of complete blood counts (CBCs) should become the routine test for the most ophthalmopathy patients in hospitals.
Complete blood count is a super diagnostic test to identify the prognosis of Graves's ophthalmopathy disease. Therapeutic goals will be supported by the prognosis of autoimmune thyroid disease, and the titer will determine the severity of illness.

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CONFLICT OF INTEREST

There are no declared conflicts of interest.

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