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Evaluation of Platelet Parameters in Patients with Thyroid Disease in Shendi Town

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Abstract

Background:

The thyroid gland is a vital endocrine organ responsible for the secretion of triiodothyronine (T3) and thyroxine (T4), hormones that regulate metabolism, growth, and tissue development. Thyroid dysfunction, including hypothyroidism and hyperthyroidism, may influence hematological parameters, particularly platelet indices. Platelet parameters are considered valuable biomarkers for assessing thrombotic and atherogenic risk in patients with thyroid disorders.

Methods:

This cross-sectional study was conducted in Shendi Town, Sudan, to evaluate platelet parameters among female patients with thyroid dysfunction. The study included 50 patients with thyroid disorders, comprising 28 patients with hyperthyroidism and 22 patients with hypothyroidism, in addition to 30 apparently healthy females as controls. Venous blood samples were collected under aseptic conditions and analyzed for platelet parameters. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), and results were expressed as mean ± standard deviation. A p-value of less than 0.05 was considered statistically significant.

Results:

No statistically significant differences were observed in platelet parameters between patients with hyperthyroidism and the control group ($P > 0.05$). In contrast, patients with hypothyroidism showed statistically significant reductions in platelet count ($P = 0.016$) and plateletcrit (PCT) ($P = 0.027$) compared with controls.

Conclusion:

Hypothyroidism was associated with decreased platelet count and plateletcrit, whereas hyperthyroidism showed no significant effect on platelet parameters. These findings suggest that thyroid dysfunction may contribute to alterations in platelet profiles, particularly in hypothyroid patients.

1. INTRODUCTION

The thyroid gland is a small endocrine organ located in the anterior region of the neck, surrounding the trachea. It plays a vital role in regulating metabolism, growth, and development through the continuous secretion of thyroid hormones into the bloodstream [1, 2].

The thyroid gland secretes two principal hormones, triiodothyronine (T3) and thyroxine (T4), which are essential for regulating body weight, energy metabolism, body temperature, and the growth of skin, hair, and nails [3, 4]. The secretion of these hormones is regulated by thyroid-stimulating hormone (TSH), also known as thyrotropin, which is released from the anterior pituitary gland under the control of thyrotropin-releasing hormone (TRH) secreted by the hypothalamus [3–5].

Thyroid disorders represent a major public health concern worldwide and are considered the second most common endocrine disorders after diabetes mellitus in adult clinical practice. If not diagnosed and treated early, thyroid dysfunction may lead to serious complications affecting multiple body systems [6, 7]. Thyroid dysfunction occurs when the thyroid gland produces either excessive or insufficient amounts of thyroid hormones. These abnormalities may be primary or secondary in origin and include disorders such as hyperthyroidism, hypothyroidism, thyroiditis, and Hashimoto's thyroiditis [8, 9].

Thyroid dysfunction has significant effects on several physiological systems and is associated with cardiovascular diseases, metabolic disturbances, mental disorders, and impaired bone health [10, 11]. In addition, thyroid hormones influence hematopoiesis and platelet production through their effects on bone marrow activity and megakaryocyte function. Thyroid dysfunction may alter bone marrow matrix proteins, including fibronectin, modify platelet function, and affect hematopoiesis in various ways [12, 13].

Furthermore, thyroid hormone receptors are expressed on hematopoietic stem cells, indicating that thyroid hormones play an important role in blood cell production, including megakaryopoiesis within the bone marrow [14]. Alterations in platelet indices, including mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT), have been associated with thyroid dysfunction. Mean platelet volume reflects the average platelet size, platelet distribution width measures platelet size variability, and plateletcrit represents the percentage of blood volume occupied by platelets [15].

Previous studies have demonstrated significant associations between thyroid disorders and platelet parameters. Platelet count has been reported to be significantly elevated in hypothyroidism, while both platelet count and mean platelet volume were found to be increased in autoimmune thyroid disease. In addition, mean platelet volume was reported to be significantly higher in patients with Graves' disease and hyperthyroidism [16].

Several studies have suggested a strong relationship between thyroid dysfunction and alterations in platelet parameters. Moreover, platelet indices are considered valuable and reliable biomarkers for assessing the future risk of atherothrombotic complications in patients with both hypothyroidism and hyperthyroidism. Therefore, evaluation of platelet parameters in patients with thyroid dysfunction may provide important clinical information regarding disease-related hematological alterations and potential cardiovascular risk.

Therefore, the present study aimed to evaluate platelet parameters among patients with thyroid dysfunction in Shendi Town, Sudan.

2. MATERIALS AND METHODS

2.1 Study Design

This was a hospital-based descriptive cross-sectional study conducted to assess platelet parameters among patients with thyroid dysfunction.

2.2 Study Area

The study was conducted at Almak Nemer Teaching Hospital in Shendi, River Nile State, Sudan. Shendi is located approximately 207 km north of Khartoum, the capital city of Sudan, and is considered one of the major cities in northern Sudan.

2.3 Study Duration

The study was conducted over a one-year period from February 2023 to February 2024.

2.4 Study Population

The study population consisted of Sudanese female patients diagnosed with thyroid dysfunction attending the outpatient clinics of Almak Nemer Teaching Hospital, in addition to apparently healthy age-matched female controls.

2.5 Sample Size

A total of 80 participants were enrolled in the study, including 50 patients with thyroid disorders and 30 healthy controls. The patient group comprised 28 patients with hyperthyroidism and 22 patients with hypothyroidism.

2.6 Inclusion Criteria

Female patients previously diagnosed with thyroid dysfunction, including hyperthyroidism and hypothyroidism, were included in the study.

2.7 Exclusion Criteria

Patients with hematological disorders, bleeding disorders, chronic inflammatory diseases, or any medical condition known to affect platelet parameters were excluded from the study.

2.8 Blood Sample Collection

Approximately 2.5 mL of venous blood was collected aseptically from each participant using standard venipuncture techniques and transferred into EDTA anticoagulant containers to prevent clot formation.

2.8.1 Sample Collection Procedure

The venipuncture site was disinfected using 70% ethanol, and a tourniquet was applied prior to sample collection. Approximately 2 mL of venous blood was withdrawn and immediately transferred into sterile

EDTA tubes. The samples were gently mixed to ensure proper anticoagulation [17].

2.9 Laboratory Analysis

2.9.1 Platelet Analysis

Platelet parameters were analyzed using an automated hematology analyzer (Mindray BC-3000, Mindray, China). All analyses were performed according to the manufacturer's instructions.

2.9.2 Principle of the Analyzer

The analyzer differentiates blood cells according to cell size using sheath flow direct current (DC) detection technology. Variations in electrical resistance are generated as blood cells pass through the detection aperture, allowing cell counting and classification. The instrument performs hematological analysis using radio frequency/direct current (RF/DC) detection, hydrodynamic focusing technology, and the sodium lauryl sulfate (SLS) hemoglobin method. Blood cell volume is determined through changes in direct-current resistance [18].

2.9.3 Analytical Procedure

Quality control procedures were performed using normal, low abnormal, and high abnormal control materials before sample analysis. EDTA-anticoagulated blood samples were aspirated into the analyzer through the sample probe, and platelet analysis was initiated automatically. Peripheral blood films were also prepared for all samples as part of laboratory quality assurance procedures [18].

2.10 Data Collection

Sociodemographic and clinical data were collected using a structured questionnaire designed specifically for the study.

2.11 Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) software version XX. Descriptive statistics were expressed as mean ± standard deviation (SD). Comparisons between study groups were performed using appropriate statistical tests, and a p-value of less than 0.05 was considered statistically significant.

2.12 Data Presentation

The analyzed data were presented in the form of tables and figures where appropriate.

2.13 Ethical Considerations

Ethical approval

for this study was obtained from the Faculty of Medical Laboratory Sciences, Shendi University. Written informed consent was obtained from all participants before participation in the study. Confidentiality and

privacy of participants' information were strictly maintained throughout the study period.

3. RESULTS

Description of Demographic Data

This cross-sectional study was conducted in Shendi to evaluate platelet parameters among female patients with thyroid dysfunction. The study population consisted exclusively of females, including both patients and healthy controls. A total of 80 participants were enrolled, comprising 50 patients diagnosed with thyroid disorders and 30 apparently healthy females who served as the control group. Among the patients, 28 were diagnosed with hyperthyroidism and 22 with hypothyroidism. The majority of participants were aged between 20 and 60 years.

Comparison between patients with thyroid dysfunction and healthy controls demonstrated differences in platelet parameters. The mean values of platelet count (PLT), mean platelet volume (MPV), plateletcrit (PCT), and platelet distribution width (PDW) among patients were 311.9 $\times 10^9$/L, 27.8 fL, 0.3%, and 16.1, respectively, whereas the corresponding values among the control group were 335.67 $\times 10^9$/L, 9.3 fL, 0.3%, and 16.4, respectively, as presented in Table)3.1(.

Table (3 – 1)Show mean of test and control

Elements	Samples	N	Mean	P. value
PLT	Test	50	311.8800	0.171
	Control	30	335.6667	
MPV	Test	50	27.2760	0.439
	Control	30	9.2533	
PDW	Test	50	16.1040	0.181
	Control	30	16.3933	
PCT	Test	50	0.29038	0.226
	Control	30	0.30860	

Comparison between patients with hypothyroidism and the control group revealed that the mean values of platelet count (PLT), mean platelet volume (MPV), plateletcrit (PCT), and platelet distribution width (PDW) among hypothyroid patients were 283.69 $\times 10^9$/L, 50.32 fL, 0.27%, and 16.04, respectively, whereas the corresponding values in the control group were 335.67 $\times 10^9$/L, 9.25 fL, 0.30%, and 16.39, respectively, as presented in Table)3.2(.

Table (3.2)Show mean of platelet parameters in hypothyroidism

Elements	Samples	N	Mean	P. value
PLT	Test	22	283.6818	0.016
	Control	30	335.6667	
MPV	Test	22	50.3182	0.243
	Control	30	9.2533	
PDW	Test	22	16.0455	0.196
	Control	30	16.3933	
PCT	Test	22	0.26795	0.027
	Control	30	0.30860	

Comparison between patients with hyperthyroidism and the control group revealed that the mean values of platelet count (PLT), mean platelet volume (MPV), plateletcrit (PCT), and platelet distribution width (PDW) among hyperthyroid patients were 334.04 ×10⁹/L, 9.17 fL, 0.31%, and 16.15, respectively, whereas the corresponding values in the control group were 335.67 ×10⁹/L, 9.25 fL, 0.31%, and 16.39, respectively, as presented in Table) 3.3(.

Table (3.3) Show mean of platelet parameters in hyperthyroidism

Elements	Samples	N	Mean	P. value
PLT	Test	28	334.0357	0.928
	Control	30	335.6667	
MPV	Test	28	9.1714	0.578
	Control	30	9.2533	
PDW	Test	28	16.1500	0.370
	Control	30	16.3933	
PCT	Test	28	0.30800	0.970

Analysis according to disease duration revealed that the mean values of platelet count (PLT), mean platelet volume (MPV), plateletcrit (PCT), and platelet distribution width (PDW) among patients with disease duration of less than 5 years were 307.77 ×10⁹/L, 35.65 fL, 0.28%, and 16.25, respectively, whereas the corresponding values among patients with disease duration of more than 5 years were 320.63 ×10⁹/L, 9.48 fL, 0.31%, and 15.80, respectively, as presented in Table)3.4(.

Table (3.4). Show mean of duration

Elements	Samples	Mean	P. value
PLT	less than 5	307.7647	0.234
	more than 5	320.6250	
MPV	less than 5	35.6500	0.567
	more than 5	9.4813	
PDW	less than 5	16.2471	0.592
	more than 5	15.8000	
PCT	less than 5	0.28076	0.501
	more than 5	0.31081	

Analysis according to age group revealed that the mean values of platelet count (PLT), mean platelet volume (MPV), plateletcrit (PCT), and platelet distribution width (PDW) among participants aged 20–40 years were 328.16 ×10⁹/L, 45.14 fL, 0.30%, and 16.1, respectively, whereas the corresponding values among participants aged more than 40 years were 295.60 ×10⁹/L, 9.41 fL, 0.27%, and 16.1, respectively, as presented in Table (3.5).

.**Table (3.5). Show mean of age**

Elements	Samples	Mean	P. value
PLT	20–40	328.1600	0.142
	more than 40	295.6000	
MPV	20–40	45.1440	0.324
	more than 40	9.4080	
	Total	27.2760	
PDW	20–40	16.1280	0.833
	more than 40	16.0800	
PCT	20–40	0.30328	0.182
	more than 40	0.27748	

4. DISCUSSION

The present study investigated the effect of thyroid dysfunction on platelet parameters among Sudanese females in Shendi. Thyroid hormones play an important role in hematopoiesis and platelet production; therefore, thyroid dysfunction may influence platelet indices and related hematological parameters [15].

In the current study, all participants were females. This finding is consistent with previous studies reporting a higher prevalence of thyroid disorders among women compared with men [19]. The increased susceptibility of females to thyroid dysfunction may be associated with hormonal, genetic, and autoimmune factors.

The present study demonstrated no statistically significant differences in platelet count (PLT), mean platelet volume (MPV), platelet distribution width (PDW), or plateletcrit (PCT) between patients with thyroid dysfunction and the control group ($P > 0.05$). These findings are inconsistent with a study conducted in Addis Ababa, which reported statistically significant increases in platelet count, MPV, and plateletcrit among patients with thyroid disorders [5]. The discrepancy between the findings may be attributed to differences in sample size, demographic characteristics, study population, and the inclusion of male participants in the previous study.

Comparison between patients with hyperthyroidism and healthy controls revealed no statistically significant differences in PLT, MPV, PDW, or PCT ($P > 0.05$). These findings disagree with the study conducted by Maniesha, which reported significant alterations in platelet parameters among patients with hyperthyroidism [19]. Variations in ethnicity, disease severity, treatment status, and laboratory methodologies may explain the differences between the studies.

Regarding hypothyroidism, the current study demonstrated no statistically significant differences in MPV and PDW compared with the control group ($P > 0.05$). This finding partially agrees with the study conducted by Maniesha, which suggested that MPV is a reliable marker for assessing platelet functional activity and vascular effects. Increased platelet activation may result in larger platelet size and morphological irregularities. Consequently, these changes may contribute to increased PDW values in patients with hypothyroidism [19]. However, the present findings disagree with those reported by Fatma, who observed statistically significant differences in MPV and PDW among hypothyroid patients [20].

In the present study, platelet count was significantly decreased in patients with hypothyroidism compared with the control group ($P = 0.016$). This finding is consistent with the study conducted by Maniesha, which also reported statistically significant alterations in platelet count among hypothyroid patients [19]. The reduction in platelet count may be associated with the suppressive effects of thyroid hormone deficiency on bone marrow activity and megakaryopoiesis.

Plateletcrit (PCT), which represents the percentage of total blood volume occupied by platelets, has been considered a useful prognostic marker in inflammatory and thrombotic conditions. In the current study, plateletcrit showed a statistically significant decrease in patients with hypothyroidism compared with controls ($P = 0.027$). This finding is in agreement with the results reported by Maniesha, who also demonstrated significant alterations in plateletcrit among patients with hypothyroidism [19]. The observed reduction in PCT may reflect decreased platelet production associated with thyroid hormone deficiency.

4.2 CONCLUSION

- • Platelet count (PLT) and plateletcrit (PCT) were significantly decreased in patients with hypothyroidism.
- • In hyperthyroidism, no statistically significant changes were observed in platelet parameters.
- • Overall, thyroid dysfunction—particularly hypothyroidism—may contribute to alterations in platelet indices, suggesting potential hematological implications that may be clinically relevant for disease assessment and follow-up.

Declarations

Conflict of Interest:

The authors declare that they have no conflict of interest.

Competing Interests

The authors declare that they have no competing financial or non-financial interests relevant to the content of this study.

Ethical Approval

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Health Research Ethics Committee at the University of Shendi, Sudan.

Informed Consent

Informed consent was obtained from all participants included in the study. All participants were clearly informed about the aim and procedures of the study, and the confidentiality and privacy of their data were strictly maintained throughout the research process.

Ethics Statement

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki for research involving human participants. Ethical approval was obtained from the Ethics Committee of the Faculty of Medical Laboratory Sciences, University of Shendi, Sudan.

Written informed consent was obtained from all participants prior to their enrollment in the study. Participants were fully informed about the aim of the study, study procedures, potential benefits, and their right to withdraw at any time without any consequences.

Confidentiality and privacy of all participants' information were strictly maintained throughout the study. All collected data were used solely for scientific research purposes and were securely handled to ensure anonymity.

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Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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