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Hypothyroidism and Platelet Parameter Evaluation

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Authors' contributions

This work was carried out in collaboration among all authors. All authors contributed equally to this work, read and approved the final manuscript.

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ABSTRACT

Aims: To evaluate the effect of subclinical and overt hypothyroidism on mean platelet volume (MPV) and platelet distribution width (PDW).
Study Design: Cross sectional study.
Place and Duration of Study: Outpatient Clinic of Diabetes, Metabolism and Endocrinology Unit in internal medicine department and clinical pathology, Tanta University, Egypt in a period between June 2018 to June 2019.
Methodology: We tested 250 subjects; 50 healthy control and 200 hypothyroid patients (all were female; age ≥18 years old age) without any medical history, then patients were subdivided into newly diagnosed group and another group on l-thyroxin treatment. Platelet parameters (MPV, PDW) were assessed in all of them.
Results: MPV & PDW is increasing in hypothyroid patients than control group (8.93 ± 0.62), more in overt group (10.88 ± 0.57) than subclinical group (10.02 ± 0.55). No significant reduction in MPV and PDW in patients on l-thyroxin treatment which suggest that l-thyroxin treatment couldn't produce difference till patients reaching their target level being euthyroid.
Conclusion: We recommend the usefulness of MPV and PDW as inexpensive markers of platelet activation in diagnostic work-up of athero-thrombotic complications risk in patients with subclinical and overt hypothyroidism.

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Keywords: Hypothyroidism; platelet activation; mean platelet volume (MPV); platelet distribution width (PDW); cardiovascular risk.

1. INTRODUCTION

Hypothyroidism is one of the most common diseases of endocrine system [1,2] in which there is multisystem derangement of physiological functions due to lack of thyroid hormones. Various changes in the hemostatic profile have been described in patients with excess and deficiency of thyroid hormones. These changes could be encountered as complicating factors in various systemic disorders like cardiovascular disorders, endocrinal disorders and gynecological disorders, etc. [2].

Mean platelet volume (MPV), plateletcreit (PCT), platelet distribution width (PDW), platelet-large cell ratio (P-LCR) and platelet count are platelet parameters which asses platelet size, morphology and anisocytosis of circulating platelets and can reflect also platelet activity [3,4].

Coronary artery disease (CAD) is the leading cause of death in many developed countries [5–8].

Thyroid hormones are an essential regulator in the development of atherosclerotic cardiovascular disease (CVD) by direct effects and contributing to risk factors [5,8,9]. Subclinical hypothyroidism (SCH) and also overt hypothyroidism (OH) accelerate atherogenesis. Even the upper range of the thyrotropin (TSH) reference range may accelerate the development of atherosclerosis in euthyroid state [8].

Platelets play an important role in athero-thrombosis. Larger platelets are likely to be more reactive, contain more granules and produce greater amounts of vasoactive and prothrombotic factors. As mean platelet volume (MPV) and also platelet distribution width (PDW) can reflect the platelet activity [2,6,7], it is a matter of value to evaluate these parameters in patient with subclinical (SCH) and overt hypothyroidism (OH) as an added link between hypothyroidism and cardiovascular events.

2. MATERIALS AND METHODS

The study included 200 patients with hypothyroidism and 50 healthy individuals of matched age and sex as controls who were selected from the Outpatient Clinic of Diabetes, Metabolism and Endocrinology Unit of Tanta university Hospitals, Egypt, according to inclusion and exclusion criteria.

Subjects were divided into 3 main groups and also subgroups aiming at evaluating the effect of l-thyroxine therapy on platelet parameters on non-controlled patients (not reaching target TSH reference range as the mean age of our patients was around thirties):

1. **(Group I):** 100 patients with Subclinical hypothyroidism (TSH level above 4mIU/l with normal FT4 and FT3 levels), then patients were subdivided to:
   (Group IA): 70 patients who were recently diagnosed.
   (Group IB): 30 patients who were on L-thyroxine treatment.
2. **(Group II):** 100 patients with overt hypothyroidism (TSH level above 4 mIU/l with low FT4 level), then patients were subdivided to:
   (Group IIA): 80 patients who were recently diagnosed.
   (Group IIB): 20 patients who were on L-thyroxine treatment.
3. **(Group III):** 50 healthy individuals as a control group.

2.1 Inclusion Criteria

Patients diagnosed to have subclinical or overt hypothyroidism ≥18 years old.

2.2 Exclusion Criteria

Pregnancy and breast feeding

Patients taking any drugs that affect Platelet as: (diuretics, b-blockers, anti-hyperlipidemic agents, anticoagulant drugs, antihistaminics or corticosteroids).

Patients with hypertension, diabetes mellitus, smoking, alcohol consumption, dyslipidemia, cardiac, renal, hepatic, and other systemic diseases (on clinical bases).

3. METHODS

Full history taking, clinical examination, routine laboratory tests, thyroid laboratory tests, hemostatic profile, HCV and bilharzial Ab, ECG

and radiological investigations (neck thyroid and pelvi-abdominal ultrasound, ECHO) for exclusion of any systemic illness could affect platelet.

3.1 Statistical Analysis of the Data

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. Significance of the obtained results was judged at the 5% level. We used Chi-square test for categorical variables, to compare between different groups, Monte Carlo correction test used for chi-square when more than 20% of the cells have expected count less than 5. We used Student t-test for normally distributed quantitative variables, to compare between two studied groups, ANOVA with repeated measures for normally distributed quantitative variables, to compare between more than two studied groups. Mann Whitney test for abnormally distributed quantitative variables, to compare between two studied groups, Friedman test for abnormally distributed quantitative variables, to compare between more than two groups. Multivariate regression analysis to detect the most independent affecting factor.

4. RESULTS

4.1 Base-Line Characteristics of Studied Main Groups and Subgroups

4.1.1 Demographic and clinical data

All of studied subjects were females as a hypothyroid patients and also control group. The age showing no statistically significant difference between the three groups and also sub groups, it was around thirty. Patients in group Ⅱ with overt hypothyroidism had significantly higher body weight and BMI than patients with subclinical hypothyroidism and also control group with P value (p=0.001) between all the three groups Table 1.

Table 1.Comparison between the different studied main groups according to demographic & clinical data

Demographic & Clinical data	Group Ⅰ (n = 100)	Group Ⅱ (n = 100)	Group Ⅲ (n = 50)	Test of sig.	p
Age (years)					
Min. – Max.	18.0 – 55.0	18.0 – 52.0	18.0 – 50.0	F=0.663	0.516
Mean ± SD.	30.93 ±7.12	30.14 ± 7.46	31.52 ± 7.17		
Median (IQR)	31.0 (26.0 – 35.75)	28.50 (24.25 – 35.0)	31.50 (25.75 – 36.25)		
BMI (kg/m^2)					
Min. – Max.	21.0 – 26.40	22.0 – 29.20	18.80 – 24.50	F=51.906*	<0.001*
Mean ± SD.	23.17 ± 1.04	23.86 ± 1.33	21.64 ± 1.47		
Median (IQR)	22.90 (22.40 – 23.90)	23.40 (22.92 – 24.58)	21.50 (20.40 – 23.0)		
Sig. bet. groups	p_1<0.001*, p_2<0.001*, p_3<0.001*				

F: F for ANOVA test, Pairwise comparison bet. each 2 groups was done using Post Hoc Test (Turkey)
H: H for Kruskal Wallis test, Pairwise comparison bet. each 2 groups was done using Post Hoc Test (Dunn's for multiple comparisons test)
p: p value for comparing between the different studied groups
p_1: p value for comparing between Group Ⅰ and Group Ⅱ
p_2: p value for comparing between Group Ⅰ and Group Ⅲ
p_3: p value for comparing between Group Ⅱ and Group Ⅲ
**: Statistically significant at p ≤ 0.05*
Group Ⅰ: Subclinical hypothyroidism (SCH)
Group Ⅱ: Overt hypothyroidism (OH)
Group Ⅲ: Control group
BMI (Body Mass Index)

Table 2. Comparison between the different studied subgroups according to demographic & clinical data

Demo graphic & Clinical data	Group ⅠA (n = 70)	Group ⅠB (n = 30)	Group ⅡA (n = 80)	Group ⅡB (n = 20)	Group Ⅲ (n = 50)	Test of Sig.	p
Age (years)							
Min. – Max.	18.0 – 51.0	19.0 – 55.0	18.0 – 52.0	22.0– 49.0	18.0– 50.0	F=	0.695
Mean ± SD.	30.84 ± 6.72	31.13 ± 8.11	29.80 ± 7.56	31.50 ± 7.04	31.52± 7.17	0.556	
Median	31.0	29.0	28.0	29.50	31.50		
IQR	27.0 – 35.0	26.0 – 37.0	23.0 – 35.0	26.50 – 34.50	26.0 – 36.0		
BMI (kg/m^2)							
Min. – Max.	21.0 – 26.40	21.60 – 24.60	22.0 – 29.20	23.0 – 24.70	18.80 – 24.50	F=	<0.001*
Mean ± SD.	23.29 ± 1.10	22.89 ± 0.86	23.92 ± 1.46	23.60 ± 0.52	21.64 ± 1.47	26.870*	
Median	23.0	22.55	23.35	23.50	21.50		
IQR	22.50 – 24.0	22.30– 23.60	22.80 – 24.80	23.15 – 23.90	20.40 – 23.0		
p_1	<0.001*	<0.001*	<0.001*	<0.001*			
Sig. bet. groups	p_2=0.585,p_3=0.021*, p_4=0.284,p_5=0.851						

F: F for ANOVA test, Pairwise comparison bet. each 2 groups was done using Post Hoc Test (Tukey)
H: H for Kruskal Wallis test, Pairwise comparison bet. each 2 groups was done using Post Hoc Test (Dunn's for multiple comparisons test)
p_1: p value for comparing between group Ⅲ and other groups
p_2: p value for comparing between Group ⅠA and Group ⅠB; p_3: p value for comparing between Group ⅠA and Group ⅡA
p_4: p value for comparing between Group ⅠB and Group ⅡB; p_5: p value for comparing between Group ⅡA and Group ⅡB
**: Statistically significant at p ≤ 0.05*
Group ⅠA: Newly diagnosed SCH not on treatment; Group ⅠB: SCH on treatment
Group ⅡA: Newly diagnosed OH not on treatment; Group ⅡB: OH on treatment; Group Ⅲ: Control

There was no statically significant difference between sub groups whether patients on l-thyroxin treatment or newly diagnosed regarding BMI but numerically patients on l-thyroxin treatment had lower BMI than newly diagnosed patients (Table 2).

4.1.2 Platelet parameters

Mean platelets volume in patients with subclinical hypothyroidism group10.02 ± 0.55, 10.88 ± 0.57 in patients with overt hypothyroidism group and 8.93 ± 0.62 in the control group Fig. 1, with statistically significant results in the three groups with p value respectively being higher in group Ⅱ (p1<0.001, p2<0.001, p3<0.001) Table 3. In sub groups, there was statistically significant difference between group ⅠA and group ⅡA with (p3<0.001) and between group ⅠB and group ⅡB with (p4<0.001) Table 4.

Platelets distribution width in patients with subclinical hypothyroidism group 12.45 ± 1.67, 14.51 ± 1.18 in patients with overt hypothyroidism group and 11.65 ± 2.0 in the control group Fig. 2, with statistically significant results in the three groups with p value respectively being higher in group Ⅱ (p1<0.001, p2=0.009, p3<0.001) Table 3. In sub groups, there was statistically significant difference between group ⅠA and group ⅡA with (p3<0.001) and between group ⅠB and group ⅡB with (p4=0.016), whether patients on l-thyroxin treatment or newly diagnosed, there was no numerical difference in MPV & PDW Table 4.

4.1.2.1 Mean platelets volume characters

Negative statistically significant results with Anti-TPO, Hb level with p value (0.001, 0.008 respectively) in group Ⅰ, with APTT (p=0.014) in group Ⅱ and with PLT count (p=0.013) in group Ⅲ but positive only with L-thyroxin dose (p=0.008) in group Ⅰ Table 5.

4.1.2.2 Platelets distribution width characters

Negative statistically significant results with L-thyroxin dose, Hb level with p value (0.032, 0.001 respectively) in group Ⅱ but positive one with BMI, diastolic BP, Hb level with p value (0.007, 0.049 and 0.036 respectively) in group Ⅲ Table 5.

Table 3. Comparison between the different studied main groups according to PLT parameters

PLT parameters	Group Ⅰ (n = 100)	Group Ⅱ (n = 100)	Group Ⅲ (n = 50)	Test of Sig.	p
MPV (fl)					
Min. – Max.	8.80 – 11.0	9.10 – 12.0	8.0 – 10.20	F=	<0.001*
Mean ± SD.	10.02 ± 0.55	10.88 ± 0.57	8.93 ± 0.62	198.758*	
Median (IQR)	10.05 (9.60 – 10.48)	11.0 (10.53 – 11.20)	8.90 (8.38 – 9.33)		
Sig. bet. groups	p_1<0.001*, p_2<0.001*, p_3<0.001*				
PDW (%)					
Min. – Max.	9.60 – 17.60	12.0 – 18.0	8.50 – 17.0	F=	<0.001*
Mean ± SD.	12.45 ± 1.67	14.51 ± 1.18	11.65 ± 2.0	69.952*	
Median (IQR)	12.0 (11.30 – 13.28)	14.55 (13.80 – 15.28)	11.15 (10.10 – 13.05)		
Sig. bet. groups	p_1<0.001*, p_2=0.009*, p_3<0.001*				

F: F for ANOVA test, Pairwise comparison bet. each 2 groups was done using Post Hoc Test (Tukey)
p: p value for comparing between the different studied groups
p_1: p value for comparing between Group Ⅰ and Group Ⅱ
p_2: p value for comparing between Group Ⅰ and Group Ⅲ
p_3: p value for comparing between Group Ⅱ and Group Ⅲ
**: Statistically significant at p ≤ 0.05*
Group Ⅰ: Subclinical hypothyroidism (SCH)
Group Ⅱ: Overt hypothyroidism
Group Ⅲ: Control group. (MPV) Mean Platelet Volume, (PDW) Platelet distribution width

Table 4. Comparison between the different studied subgroups according to PLT parameters

PLT parameters	Group ⅠA (n = 70)	Group ⅠB (n = 30)	Group ⅡA (n = 80)	Group ⅡB (n = 20)	Group Ⅲ (n = 50)	Test of Sig.	p
MPV (fl)							
Min. – Max.	8.80 – 11.0	9.0 – 11.0	9.10 – 12.0	10.70 – 11.40	8.0 – 10.20	F=	<0.001*
Mean ± SD.	9.93 ± 0.53	10.24 ± 0.53	10.85 ± 0.63	11.01 ± 0.19	8.93 ± 0.62	103.606*	
Median	10.0	10.40	11.0	11.0	8.90		
IQR	9.60 – 10.30	10.0 – 10.60	10.50 – 11.30	10.90 – 11.15	8.40 – 9.30		
p_1	<0.001*	<0.001*	<0.001*	<0.001*			
Sig. bet. groups	p_2=0.085, p_3<0.001*, p_4<0.001*, p_5=0.794						
PDW (%)							
Min. – Max.	9.60 – 17.50	10.80 – 17.60	12.0 – 18.0	12.60 – 16.30	8.50 – 17.0	F=	<0.001*
Mean ± SD.	12.39 ± 1.71	12.60 ± 1.59	14.63 ± 1.19	14.02 ± 1.03	11.65 ± 2.0	35.779*	
Median	11.85	12.25	14.60	13.80	11.15		
IQR	11.20 – 13.20	11.70 – 13.50	13.80 – 15.55	13.30 – 14.55	10.10 – 13.0		
p_1	0.082	0.068	<0.001*	<0.001*			
Sig. bet. groups	p_2=0.973, p_3<0.001*, p_4=0.016*, p_5=0.533						

F: F for ANOVA test, Pairwise comparison bet. each 2 groups was done using Post Hoc Test (Tukey)
H: H for Kruskal Wallis test, Pairwise comparison bet. each 2 groups was done using Post Hoc Test (Dunn's for multiple comparisons test) p_1: p value for comparing between group Ⅲ and other groups
p_2: p value for comparing between Group ⅠA and Group ⅠB
p_3: p value for comparing between Group ⅠA and Group ⅡA
p_4: p value for comparing between Group ⅠB and Group ⅡB
p_5: p value for comparing between Group ⅡA and Group ⅡB
**: Statistically significant at p ≤ 0.05 Group ⅠA: Newly diagnosed SCH not on treatment; Group ⅠB: SCH on treatment*
Group ⅡA: Newly diagnosed OH not on treatment; Group ⅡB: OH on treatment; Group Ⅲ: Control

Table 5. Correlation between MPV, PDW and different parameters in each main group

	MPV (fl)						PDW (%)					
	Group Ⅰ (n = 100)		Group Ⅱ (n = 100)		Group Ⅲ (n = 50)		Group Ⅰ (n = 100)		Group Ⅱ (n = 100)		Group Ⅲ (n = 50)	
	r	p	r	p	r	p	r	p	r	p	r	p
Age (years)	0.133	0.188	-0.052	0.609	-0.013	0.928	0.192	0.056	0.071	0.482	0.233	0.103
BMI (kg/m2)	-0.038	0.708	0.147	0.146	0.183	0.204	0.081	0.425	-0.056	0.581	0.374	0.007*
Systolic BP (mm.Hg)	-0.007	0.943	0.069	0.494	0.155	0.284	0.125	0.216	-0.038	0.704	0.240	0.094
Diastolic BP (mm.Hg)	0.064	0.528	0.167	0.096	0.081	0.577	0.044	0.667	0.079	0.434	0.279	0.049*
TSH (mIU/L)	-0.101	0.315	0.087	0.390	0.009	0.950	-0.029	0.776	0.025	0.807	0.147	0.310
FT4 (Ug/dl)	0.201	0.045	0.132	0.190	-0.263	0.065	-0.015	0.881	-0.006	0.951	-0.130	0.367
FT3 (ng/ml)	-0.046	0.646	0.088	0.384	-0.199	0.166	-0.063	0.535	0.042	0.677	-0.067	0.645
Anti –TPO (mIU/L)	-0.322	0.001*	-0.043	0.674	0.246	0.086	0.076	0.450	-0.011	0.911	0.099	0.493
L-Thyroxin dose (µg)	0.262	0.008*	0.094	0.352	–	–	0.074	0.464	-0.215	0.032*	–	–
PT (sec.)	0.062	0.539	-0.094	0.353	0.020	0.892	-0.063	0.531	0.018	0.857	0.172	0.234
APTT (sec.)	-0.038	0.704	-0.246	0.014*	0.007	0.963	-0.182	0.070	-0.212	0.034	-0.038	0.795
Hb level(g/dl)	-0.263	0.008*	0.013	0.900	-0.114	0.429	0.053	0.603	-0.335	0.001*	0.298	0.036*
WBCs (/ul)	-0.120	0.235	-0.026	0.799	0.153	0.290	-0.023	0.823	0.169	0.092	0.231	0.106
PLT count (x10^3/ul)	-0.008	0.933	-0.181	0.071	-0.349	0.013*	-0.127	0.209	-0.020	0.844	-0.110	0.448

*r_s: Spearman coefficient; *: Statistically significant at p ≤ 0.05*

(BP) Blood Pressure, (TSH) Thyroid Stimulating Hormone, (FT3) Free tri-iodothyronine, (FT4) Free thyroxine, (TPO) Thyroid Peroxidase, (PT) Prothrombine Time, (APTT) Activated Partial Thromboplastin Time, (HB) Hemoglobin, (WBCs) White Blood Cells, (PLT) Platelets

4.2 Univariate and Multivariate Regression Analysis for the Parameters Affecting MPV & PDW

Univariate and multivariate regression analysis was done using the only significant different variants at baseline. We found that patients of group Ⅰ who were with subclinical hypothyroidism, the MPV was affected by, Anti-TPO level, L-thyroxin dose and Hb level, in patients of group Ⅱ who were with overt hypothyroidism APTT was the independent factor affecting MPV.

Regarding PDW was affected by L-thyroxin dose and Hb level in group Ⅱ while in group Ⅲ who were control BMI and Hb level were the independent factors affecting PDW.

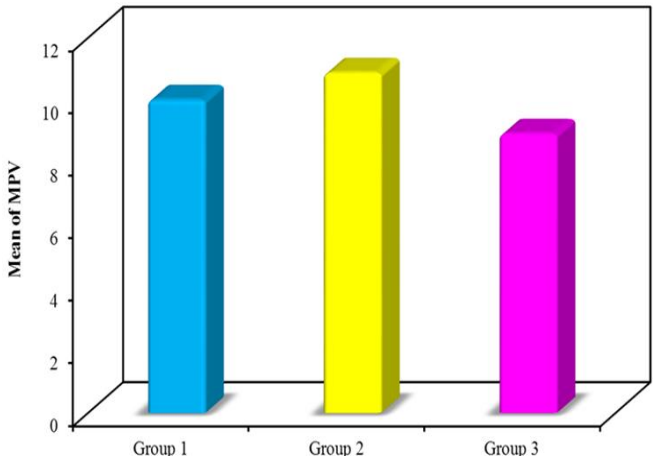

Fig. 1. Comparison between the studied main groups according to MPV

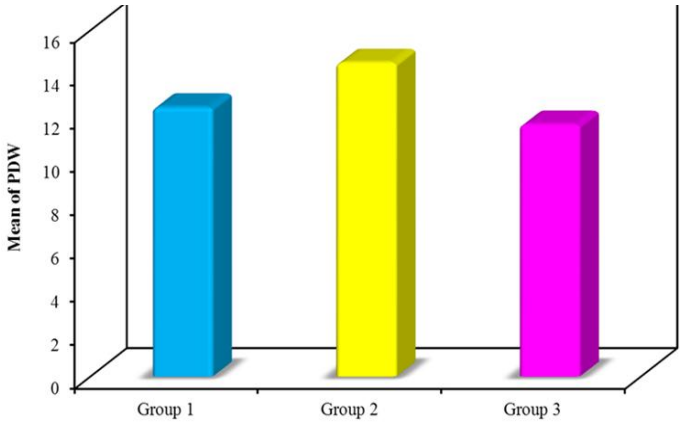

Fig. 2. Comparison between the studied main groups according to PDW

Table 6. Univariate and multivariate analysis for the parameters affecting MPV in group Ⅰ (n = 100)

MPV(fl)	Univariate		#Multivariate	
	p	B(95%C.I)	p	B(95%C.I)
Anti TPO(mIU/L)	0.001*	–0.007 (–0.011 – -0.003)	0.002*	–0.006 (–0.10 – -0.002)
L Thyroxin dose(Mcg)	0.008*	0.003 (0.001 – 0.006)	0.001*	0.004 (0.002 – 0.006)
Hb level(g/dl)	0.008*	–0.245 (–0.426 – -0.065)	0.031*	–0.190 (–0.362 – -0.017)

Beta: Unstandardized Coefficients
C.I: Confidence interval
*#: All variables with p<0.05 was included in the multivariate, *: Statistically significant at p ≤ 0.05*

Table. 7. Univariate and multivariate analysis for the parameters affecting MPV in group Ⅱ (n = 100)

MPV(fl)	Univariate		#Multivariate	
	p	B(95%C.I)	p	B(95%C.I)
APTT(sec.)	0.014*	–0.059(–0.106 – -0.013)	0.014*	–0.057 (–0.102 – -0.012)

Beta: Unstandardized Coefficients
C.I: Confidence interval
#: All variables with p<0.05 was included in the multivariate
**: Statistically significant at p ≤ 0.05*

Table 8. Univariate and multivariate analysis for the parameters affecting PDW in group Ⅱ (n = 100)

PDW (%)	Univariate		#Multivariate	
	p	B(95%C.I)	p	B(95%C.I)
L Thyroxin dose(µg)	0.032*	–0.005 (–0.010 – 0.0)	0.013*	–0.005 (–0.010 – –0.001)
Hb level (g/dl)	0.001*	–0.734 (–1.149 – -0.320)	0.001*	–0.719(–1.130 – –0.307)

Beta: Unstandardized Coefficients
C.I: Confidence interval
#: All variables with p<0.05 was included in the multivariate
**: Statistically significant at p ≤ 0.05*

Table 9. Univariate and multivariate analysis for the parameters affecting PDW in group Ⅲ (n = 50)

PDW	Univariate		#Multivariate	
	p	B(95%C.I)	p	B(95%C.I)
BMI (kg/m2)	0.007*	0.509 (0.143 – 0.876)	0.005*	0.512 (0.161 – 0.863)
Hb level(g/dl)	0.036*	0.675 (0.047 – 1.303)	0.023*	0.680 (0.096 – 1.263)

Beta: Unstandardized Coefficients
C.I: Confidence interval
#: All variables with p<0.05 was included in the multivariate
**: Statistically significant at p ≤ 0.05*

5. DISCUSSION

Over the past decade, to our knowledge, the study by Coban E et al. [5], was the first study to evaluate MPV in subjects with subclinical hypothyroidism.

Our study aims to evaluate the effect of subclinical and overt hypothyroidism on mean platelet volume (MPV) and platelet distribution width (PDW) which reflect the platelet activity as an added link between hypothyroidism and cardiovascular events.

In our study, we found that MPV & PDW are increasing in hypothyroid patients more in overt group than subclinical group, there was no significant reduction in MPV, PDW and BMI in patients on l-thyroxin treatment which suggest that l-thyroxin treatment couldn't produce difference till patients reaching their TSH target level being euthyroid.

By studying baseline characteristics, we found that all of participants were females; this was in agreement with Manji et al. [10] who proved that the incidence of thyroid disorders is reported to be higher in women than in men.

The range of age in patients with SCH was (18 – 55) years old, in patients with OH was (18 – 52) and in the control group was (18 – 50) with no statistical difference according to age in between the three groups in agreement with Vanderpump MPJ and Tunbridge WMG 2005 [11], who said that hypothyroidism commonly affects people over the age of 60, but can begin at any age.

Data of our study also demonstrated that BMI is higher in patients with OH than patients with SCH. That was in agreement with Peter et al. [12]. Regarding subgroups, no statically significant difference in BMI between newly diagnosed patients and who were on l-thyroxin treatment (but not controlled) but numerically

patients were on l-thyroxin treatment had lower BMI than newly diagnosed patients was in agreement with Ríos-Prego M et al. [13] who reported that hypothyroid and hyperthyroid patients after treatment and normalization of thyroid function have statistically significant changes in BMI, but these do not show great relevance in clinical practice because the BMI remained in the overweight range in both groups.

Our present study showed that there was increase in MPV and PDW being higher in overt group.

Scavuzzo F et al. [3], Erikci AA et al. [6], Yilmaz H et al. [7], Findikli HA and Tutak AS [14], all were supporting our study as they reported that there was elevated MPV and PDW levels in patients with SCH and suggested that MPV and PDW are the reliable markers among the platelet parameters, could be used as a CVD risk evaluation parameters in hypothyroid patients.

Ren X et al. [4] was against as their study could not identify any associations between MPV or PDW and thyroid function.

We found there was significant difference between newly diagnosed and patients on l-thyroxin treatment (patients still not controlled yet) but numerically there was no evident reduction in MPV and PDW whether Atile NS et al. [15] found that a significant decrease in the mean MPV level was detected after the maintenance of euthyroidism with LT4 treatment.

Yang K et al. [16] reported that MPV was negatively associated with DBP, where PDW had a negative association with SBP, in comparison to our study MPV had no association with blood pressure, PDW was positively associated with DBP, that difference may be due to gender difference between both studies (in our study all were females while these results were described in males in the compared study).

6. CONCLUSION

MPV & PDW are increasing in hypothyroid patients more in overt group than subclinical group. No significant reduction in MPV, PDW and BMI in patients on l-thyroxin treatment which suggest that l-thyroxin treatment couldn't produce difference till patients reaching their TSH target level being euthyroid. We recommend the usefulness of MPV and PDW as inexpensive markers used as a CVD risk evaluation parameters in hypothyroid patients.

CONSENT

Informed written consent was obtained from all patients after a full explanation of the benefits and risks of the study. Privacy of all patients' data is granted by a special code number for every patient file that includes all investigations.

ETHICAL APPROVAL

The protocol was approved by the local ethics committee to conduct this study and to use the facilities in the hospital.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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