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Hypothyroidism and platelet parameter evaluation: a preliminary study

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OBJECTIVES

According to the findings of recent epidemiological research, thyroid complaints are among the most frequent endocrine illnesses in Italy. Being positively correlated to MPV, the mean platelet volume, in subjects with hypothyroidism, it has been hypothesized in literature that TSH can have a probable prothrombotic effect. MPV (Mean Platelet Volume), PCT (Plateletcrit), PDW (Platelet Distribution Width) and P-LCR (Platelet-Large Cell Ratio) are platelets parameters provided by automated hematology analyzers (HA) along with the total platelet count (PLT). These parameters measure the size as also the morphology and the degree of anisocytosis of circulating platelets, and they can reflect platelet activity. The aim of this study was to evaluate whether platelet indices can undergo alterations in subjects affected by subclinical and overt clinical hypothyroidism

METHODS

Between September-December 2014, 60 individuals of both sexes aged between 18 and 45 years, all unaffected by other pathologies, were enrolled: 20 with overt clinical hypothyroidism (OH), 20 with subclinical hypothyroidism (SCH) and 20 healthy euthyroid subjects (HES, control group). They all consented to give peripheral venous blood samples for biochemical (fT3, fT4, TSH thyroid hormones), hemostasis (PT, APTT, Fibrinogen activity) and platelet parameters (PLT, MPV, PCT, PDW, and P-LCR) examination. fT3, fT4 and TSH levels were measured by fluorimetric enzyme immunoassay (FEIA) on a fully automated immunoassay analyzer (Tosoh AIA-2000 ST). PT, APTT and FBG were determined by coagulometric measurement on a fully automated hemostasis analyzer (ACL Top, Werfen). Platelets were measured on a Sysmex XE2100 (Sysmex Corp., Japan). The Sysmex XE2100 is a fully automated HA that uses impedance technology with hydrodynamic focusing for platelet counting. A platelet size distribution histogram is produced for each peripheral blood sample in order to evaluate platelet size and morphology parameters (Figure 1). The mean values and the distribution of MPV, PCT, PDW and P-LCR observed in the three groups of subjects were statistically evaluated with parametric t-test of Student and linear mixed model. A p-value less than 0.05 was considered statistically significant.

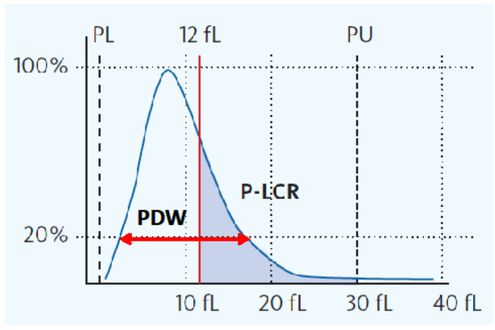

Figure 1 : histogram of Platelet size distribution

*The **P-LCR** indicates the percentage of large platelets with a volume >12 fL. An increase of P-LCR may be an indication for giant platelets. The **PDW** indicates the platelet distribution width measured at 20% relative height of the total height of the PLT histogram. An increased PDW is an indication for the anisocytosis of platelets. The **PCT** is equivalent to the sum of platelet impulses which are individually detected by means of the impedance measurement. It is the equivalent to the haematocrit of the red blood cells. The **MPV** is determined as a ratio between the PCT and PLT count. It reflects the average size of platelets. It is higher in disorders with increased production and/or destruction of platelets.*

RESULTS

The mean values of platelet parameters, thyroid function tests and hemostasis parameters observed in the study groups are shown in Table 1. Mean values in subclinical hypothyroid (SCH) and overt hypothyroid patients (OH) were compared with those of healthy subjects (HES). The p-value of t-test of Student are shown in Table 2. Platelet counts, P-LCR and PCT were not different between the study groups (p>0.05). Compared with the results of the HES group (mean±SD: 8.4±0.93 fL), MPV values were higher in the SCH group (9.0±0.72 fL, p=0.0002) and, more significantly, in the OH group (9.8±0.95 fL, p<0.0001). Similarly, PDW values were significantly higher in the SCH group (13.8±1.26 fL, p=0.0016) and in the OH group (15.2±2.06 fL, p<0001) than in the HES group (12.9±2.03 fL).
The distribution of MPV and PDW in the three study groups are shown in Figure 2 and Figure 3, respectively.

***Figure 2**: MPV values*

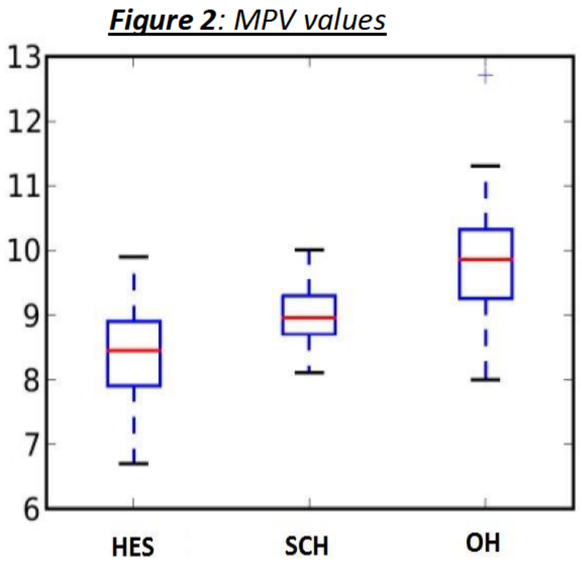

***Figure 3**: PDW values*

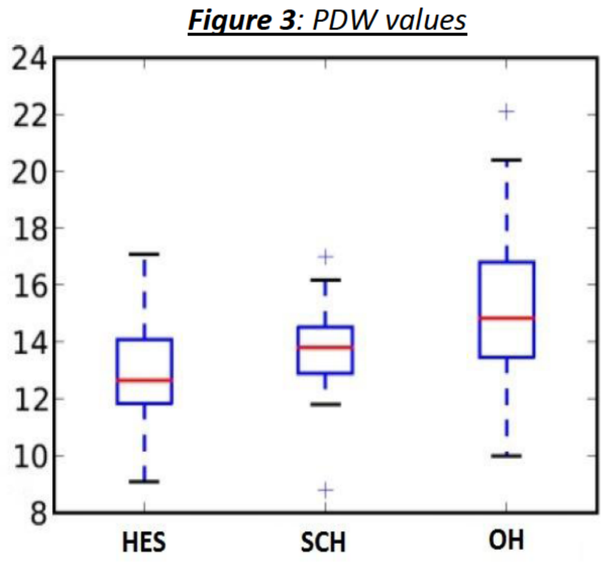

***Table 1**: mean values of PLT parameters, thyroid hormones and hemostasis parameters*

Group	PLT x10⁹/L	MPV fL	PDW fL	PCT %	P-LCR %	fT3 pg/mL	fT4 ng/dL	TSH µIU/mL	PT INR	APTT Ratio	FBG mg/dL
HES	273	8.4	12.9	0.28	27.2	2.92	1.23	2.61	1.00	0.98	310
SCH	278	9.0	13.8	0.28	28.2	2.91	1.16	6.66	1.00	1.00	309
OH	277	9.8	15.2	0.30	26.7	2.12	0.81	19.91	0.76	0.98	317

***Table 2**: p-values*

Group	PLT	MPV	PDW	PCT	P-LCR	fT3	fT4	TSH	PT	APTT	FBG
HES vs SCH	0.69	0.0002	0.016	0.40	0.38	0.86	0.11	<0.0001	0.65	0.32	0.94
HES vs OH	0.76	<0,0001	<0,0001	0.76	0.37	<0.0001	<0.001	<0.0001	<0.0001	0.99	0.60

CONCLUSIONS

Hypothyroidism is associated with a worse cardiovascular risk factor profile and leads to progression of atherosclerosis. The results of our study show that MPV and PDW values are significantly higher in patients with subclinical hypothyroidism and, more significantly, in patients with overt hypothyroidism. Even if the mechanisms for increased platelet indices as an indicator of platelet activation in patients with atherosclerosis has not been elucidated, our results suggest (as already reported in previous studies) the usefulness of MPV and PDW indices as a useful and inexpensive markers of platelet activation in the diagnostic work-up of the risk of atherothrombotic complications in patients with subclinical and overt hypothyroidism. However, due to the small sample size of our preliminary study, it is needed to perform further investigations in a larger group of patients in order to assess the clinical usefulness of platelet parameters for the evaluation of cardiovascular risk factor in these patients.

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