Assessment of Complete Blood Count in Patients with Coronary Artery Disease

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Abstract

Background   Several studies have demonstrated the role of hematological parameters like hemoglobin (Hb), white blood cells (WBC) count and platelet count in the assessment of patients with coronary artery disease; some studies suggest an additional role of platelet indices in the prognosis of patients with coronary artery disease.

Objective   To assess complete blood count and platelet indices in patients with coronary artery disease.

Methods   Blood sample of 42 newly diagnosed ischemic heart disease patients including 20 patients with myocardial infarction (MI) and 22 patients with unstable angina were studied. The control group included 15 individuals with no history of heart disease and a normal electrocardiogram. Clinical and laboratory information regarding age, sex, packed cell volume, WBC count, platelets count, platelet distribution width and platelet volume were obtained.

Results   The frequency of diabetes and smoking was higher in patients with coronary heart disease in comparison to the control group ($P < 0.05$), while the frequency of hypertension was not significntly different. Significant difference in WBC count and Hb level of patients with coronary heart disease ($P < 0.05$), while no significant difference in the platelet count, platelet distribution width and mean platelet volume was found. In patients with unstable angina there was a significant difference in the Hb level ($P < 0.05$) while no significant difference in WBC count, platelet count, platelet distribution width and mean platelet volume was observed. In patients with myocardial infarction, there was a significant difference in the Hb level and the WBC count ($P < 0.05$), whereas no significant difference in platelet count, platelet distribution width and mean platelet volume was found.

Conclusion   Hemoglobin level was significantly lower in patients with coronary artery disease while the mean level of WBC count was significantly higher than that of the control group. There was no significant difference in platelet count and platelet indices between those two groups. In patients with unstable angina the WBC count was not statistically different from that of the control group.

Key words   Coronary artery disease, Hb, WBC, PDW, MPV.

List of Abbreviation: CHD = Coronary Heart Disease, MI = Myocardial Infarction, PCV = Packed Cell Volume, WBC = White Blood Cells, PDW = Platelet Distribution Width, MPV = Mean Platelet volume, EDTA = Ethylene Diamine Tetra Acetic acid

Introduction

Coronary heart disease (CHD) is the most common form of heart disease and is the single most important cause of premature death in Europe. By 2020, it is estimated that it will be the major cause of death in all regions of the world. Disease of the coronary arteries is almost always due to atheroma and its complications, particularly thrombosis [1].

Angina pectoris is the symptom complex caused by transient myocardial ischemia; it may occur whenever there is an imbalance between myocardial oxygen supply and demand. Unstable

angina is a clinical syndrome that is characterized by new-onset or rapidly worsening angina, angina on minimal exertion or angina at rest. The condition shares common pathophysiological mechanisms with acute myocardial infarction and the term 'acute coronary syndrome' is used to describe these disorders collectively [1]. Myocardial infarction (MI) is due to the formation of occlusive thrombus at the site of rupture or erosion of an atheromatous plaque in a coronary artery [1].

Ischemic heart disease is mainly caused by atherosclerosis and its complications. Platelets and their activity have an important role in initiation of atherosclerotic lesions and coronary thrombus formation. Larger platelets are enzymatically and metabolically more active and have a higher potential thrombotic ability as compared with smaller platelets [2].

Inflammation is a key feature of atherosclerosis and its clinical manifestations. The leukocyte count is a marker of inflammation that is widely available in clinical practice. WBC counts are a predictor of coronary heart disease mortality independent of the effects of smoking and other traditional cardiovascular disease risk factors [3].

The objective of this study was to assess variations in complete blood count and platelet indices in patients with coronary artery disease compared to healthy individuals.

Methods

This study is a case-control study, which was designed to include 42 cases with ischemic heart disease; 20 patients had MI and 22 had unstable angina. The diagnosis was based on history and characteristic electrocardiographic changes. The third group comprised 15 aged and sex matched healthy controls with no history of heart disease and a normal electrocardiogram.

Medical history was taken for patients including history of hypertension and/or diabetes mellitus in addition to drug history and smoking.

This study was conducted from August 2013 to October 2013 on the blood sample of 42 newly diagnosed ischemic heart disease patients including 20 patients with MI and 22 patients with unstable angina, in addition to 15 control individuals with no history of heart disease and a normal electrocardiogram. The cases were collected from the Coronary Care Unit of Al-Kadhimiya Teaching Hospital. Clinical and laboratory information regarding age, sex, packed cell volume (PCV), white blood cells (WBC) count, platelets count, platelet distribution width (PDW) and mean platelet volume (MPV), were obtained. Two milliliters of k3 ethylenediamine tetra acetic acid (EDTA) blood was obtained from each patient and a full blood count was performed within 2 to 4 hours using the Sysmex blood analyser.

Statistical analysis

Data were analyzed using SPSS version 16 and Microsoft Office Excel 2007. Data were presented as mean ± SD or as number and percent. One way ANOVA and LSD tests were used to compare means of more than two groups while t-test was used to compare means of two groups. Chi-square test was used to compare frequency. P-value less than 0.05 was considered significant.

Results

In this study, thirty three of the patients with coronary heart disease were males (78.6%) and 9 of them were females (21.4%) with a male to female ratio of 3.6:1; on the other hand, 9 of 15 control cases were males (60%), while 6 were females (40%) with a male to female ratio of 1.6:1. There was no significant difference in gender of patients with coronary artery disease and control group.

The age range of patients with coronary heart disease was between 33-76 years with a mean of 58.8 ± 11 (mean ± SD) years. By dividing the patients` age according to 10-year intervals, the largest number of patients (13 out of 42) fall in the age group 50-59. Regarding the control group, the age range was between 14-38 years and the mean was 24.7 ± 7 (mean ± SD) years, with the largest number of cases falling in the 20-29 years age group. This study showed that there was a significant difference ($P < 0.05$) in age of patients with coronary artery disease and the control group.

When evaluating the risk factors for coronary artery disease, this study showed that the frequency of diabetes and of smoking was higher in patients with coronary heart disease in comparison to the control group ($P < 0.05$), while the frequency of hypertention was not significntly different in patients with coronary artery disease in comparison to the control group (Table 1).

Table 1. Age, gender, and frequency of various risk factors in patients with coronary artery disease

Parameter	Coronary artery disease (N = 42)		Control (N = 15)		P value
	No.	%	No.	%	
M/F	33/9		9/6		0.185
Age (yrs)	58.83	11.47	24.73	7.39	0.000
Hypertension	17	40.48	2	13.33	0.056
Diabetes	22	52.38	1	6.67	0.002
Smoking	10	23.81	0	0	0.049

In the current study, thirteen patients with unstable angina were males while nine patients were females. On the other hand all patients with myocardial infarction were males. There was a significant difference in gender of patients with unstable angina as compared to myocardial infarction in which there was male predominance, $P = 0.001$. This study revealed that smoking, hypertention and diabetes millutes have no significant difference in frequency between unstable angina and myocardial infarction (Table 2).

Table 2. Age, gender, and frequency of various risk factors in patients with unstable angina and myocardial infarction

Parameter	Unstable angina		Myocardial Infarction		Total		P value
	No.	%	No.	%	No.	%	
M/F	13/9		20/0		33/9		0.001
Age (yrs)	59±11.48		58.65±11.74		58.83±11.46		0.923
Hypertension	8	36.36	9	45	17	40.48	0.569
Diabetes	12	54.55	10	50	22	52.38	0.768
Smoking	4	18.18	6	30	10	23.81	0.477

Regarding the hematological parameters, there was a significant difference in WBC count and hemoglobin (Hb) level of patients with coronary heart disease in comparison with that in the control group ($P < 0.05$). No significant difference in the platelet count, platelet distribution width and mean platelet volume was found between patients with coronary heart disease and the control group (Table 3). Regarding patients with unstable angina there was no significant difference in WBC count, platelet count, platelet distribution width and mean platelet volume between the unstable angina group and the control group ($P > 0.05$); on the other hand there was a significant difference ($P < 0.05$) in the Hb level (Table 4).

The mean age of patients complaining from unstable angina was 59±11.4 (mean ± SD) years and the mean age of patients complainig from myocardial infarction was 58.6±11.7 (mean ± SD) years and the mean age of the control group was 24.73±7.3 (mean ± SD) years. This study showed that patients with unstable angina and MI were

significantly ($P < 0.001$) older than the control group (Tables 4 and 5).

In patients with myocardial infarction, there was no significant difference in platelet count, platelet distribution width and mean platelet volume between the myocardial infarction group and the control group ($P > 0.05$), whereas there was a significant difference ($P < 0.05$) in the Hb level and the WBC count (Table 5).

Table 3. Hematological parameters in the coronary artery diseased group and the control group

Parameter	Coronary artery disease (N = 42)	Control (N = 15)	P value
	Mean±SD	Mean±SD	
Hb (g/dl)	13.50 ± 2.39	15.53 ± 1.95	0.005
WBC (x10^9)	11.77 ± 4.55	7.65 ± 1.33	0.000
Platelet (x10^9)	230.98 ± 69.41	223.33 ± 40.19	0.690
PDW (%)	14.36 ± 3.2	13.68 ± 1.52	0.435
MPV (fl)	10.50 ± 1.66	10.57 ± 0.53	0.826

Table 4. Comparison of age and hematological parameters between unstable angina group and the control group

Parameter	Unstable Angina (N = 22)	Control (N = 15)	P value
	Mean±SD	Mean±SD	
Age (yrs)	59.0 ± 11.48	24.73 ± 7.39	< 0.001
Hb (g/dl)	13.39 ± 1.89	15.53 ± 1.95	0.008
WBC (x10^9)	9.79 ± 3.89	7.65 ± 1.33	0.079
Platelet (x10^9)	220.64 ± 77.74	223.33 ± 40.19	0.899
PDW (%)	15.13 ± 3.71	13.68 ± 1.52	0.127
MPV (fl)	10.82 ± 1.78	10.57 ± 0.53	0.604

Table 5. Comparison of age and hematological parameters between myocardial infarction group and the control group

Parameter	Myocardial Infarction (N = 20)	Control (N = 15)	P Value
	Mean±SD	Mean±SD	
Age (yrs)	58.65 ± 11.74	24.73 ± 7.39	< 0.001
Hb (g/dl)	13.61 ± 2.89	15.53 ± 1.95	0.018
WBC (x10^9)	13.96 ± 4.28	7.65 ± 1.33	< 0.001
Platelet (x10^9)	242.35 ± 58.78	223.33 ± 40.19	0.382
PDW (%)	13.51 ± 2.34	13.68 ± 1.52	0.856
MPV (fl)	10.16 ± 1.48	10.57 ± 0.53	0.406

Discussion

In this study, 78.6% of the patients with coronary heart disease were males and 21.4% of them were females with a male to female ratio of 3.6:1, which is in line with Debra *et al* [4] and Michaels *et al* [5] who stated that at any given

age the prevalence of coronary artery disease is higher in men than in women. Moreover, there was a significant difference between unstable angina and myocardial infarction in terms of gender, where females complaining from myocardial infarction were significantly lower than those complaining from unstable angina; this may support Shehab *et al* [6] who found gender differences in acute coronary syndrome.

The current study showed that there was an increased incidence of developing coronary artery disease with older age, which agrees with Michaels *et al* [5].

When evaluating the risk factors for coronary artery disease, this study showed that diabetes and smoking were more frequently found among patients with coronary heart disease in comparison to the control group and thus may have an important effect in the development of coronary heart disease, which is in concordance with Michaels *et al* [5] and Véronique *et al* [7] studies. However, the frequency of hypertension in patients with coronary artery disease was not significantly different from that of control group. This disagrees with many studies including Michaels *et al* [5] and Véronique *et al* [7] studies. This difference may be attributed to the small sample size.

Regarding WBC count, there was a significant increase in the WBC count in patients with coronary heart disease compared to control group, this finding is in agreement with Madjid *et al* [8], Hoffman *et al* [9], and Lee *et al* [10] who found that patients with elevated white blood cell counts are at higher risk of developing acute myocardial infarction and acute coronary events. Regarding the Hb level, there was a significant decrease in the Hb in patients with coronary heart disease compared to the control group. This finding agrees with Asimacopoulos *et al* [11] who found that anemia can be manifested as angina due to decreased oxygen carrying capacity to the heart.

This study showed that there was no significant difference in the platelet count, platelet distribution width and mean platelet volume between patients with coronary heart disease and the control group. This finding does not agree with Khandekar *et al* [12] who found that platelet distribution width and mean platelet volume are significantly raised in patients with acute myocardial infarction and unstable angina, however Beyan *et al* [13], Stokol *et al* [14], and George [15] stated that mean platelet volume is not a reliable index with the use of EDTA in complete blood count, because the EDTA causes time dependent variation in the platelet size indicating that the platelet volume will increase by 30% within 5 minutes of exposure to EDTA; so they stated that MPV measurements should be standardized before depending on it in the diagnosis.

In conclusion, hemoglobin level was significantly lower in patients with coronary artery disease while the mean level of WBC count was significantly higher than that of the control group. There was no significant difference in platelet count and platelet indices between those two groups. In patients with unstable angina the WBC count was not statistically different from that of the control group.

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