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Original Research Article

A Study to Evaluate the Platelet Count and Platelet Indices in Patients with Hyperlipidemia: An Observational Study

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Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to evaluate the platelet count and platelet indices in patients with hyperlipidemia.

Methods: This was a prospective study carried out at Department of Pathology, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India. The study included all patients of both sexes above 20 years of age coming to our diagnostic centre for routine health checkup. These patients underwent lipid profile testing after 12-14 hours of overnight fasting and a complete blood count as a part of their routine health checkup. 100 patients with hyperlipidemia without any associated diseases and 100 controls with normal lipid profile were included in the study.

Results: The patients were divided into 21-40, 41-60, 61-80 and > 80 years of age in both the sexes. Maximum number of patients were in 41-60 years of age (64%) followed by 27% in 21-40 years of age, 8% in 61-80 years age group and one patient above 80 years of age.65% were male and 35% were females. The mean age was 47.3 ± 12.8 in study group and 48.6 ± 12.6 in the control group. The mean cholesterol ,mean triglyceride and mean HDL cholesterol level in study group was 218.6±36.3, 244.3±154, 38.7±9.6 respectively and 158±26.8 ,94.1±34.8,and 42.1±9.3 in control group respectively. Mean LDL cholesterol was 131.1±39.4 in study group and 97.1±25.2 in control group. There was significant difference in cholesterol, triglyceride and LDL cholesterol levels in both the groups. When platelet parameters were compared in both the groups, it was observed that the mean platelet count was 320±78.8 in study group as compared to 306±76.8 in control group. There was a significant difference in platelet counts in both groups with a p value of 0.01. PCT and MPC also showed a p value of 0.04. The mean platelet mass (MPM) was 2.17±0.2 in study group as compared to 2.13±021 in control group. Large platelet count was 7.09±4.9 in study group while it was 5.95±3.81 in control group which was also significantly different. However, the PLC-R did not show a significant difference in both groups.

Conclusion: Hyperlipidemia may cause a variety of thromboembolic complications and platelet indices reported by modern day automated haematology analysers are used to assess the risk of such events in hyperlipidemic patients. Our study indicates that PCT, MPM, large platelets and platelet count are significantly higher in hyperlipidemia patients.

Keywords: platelet count, platelet indices, hyperlipidemia

Introduction

The dyslipidemia is a risk factors for cardiovascular disease (CVD) and diabetes. These factors include elevated triglyceride levels, low high-density lipoprotein levels, elevated cholesterol and obesity. [1] Non-communicable diseases which include Diabetes mellitus and cardiovascular disease are world's biggest killer diseases, estimated to cause3.5milliondeatheachyear.Eighty percent of them are found in the low and middle income countries. The WHO has developed an action plan for implementation of global strategies in prevention and control of non-communicable diseases. Ischemic heart disease is the leading cause of death worldwide. Platelets have definite role in causing its pathogenesis and its complications. A variety of data indicate patients with dyslipidemia have a high risk of developing cardiovascular morbidity and mortality. [2,3]

Platelets play an important role in the pathogenesis of thrombosis and atherosclerosis. Activated platelets interact with endothelium and other inflammatory cells by the action of different molecules present on the platelet surface and/or stored in platelets granules, as P-selectin. [4] Platelet volume reflects platelet reactivity [5] and has been suggested as an independent risk factor for ischemic events in cardiovascular disease. [6] Large platelets are metabolically and enzymatically more active than small platelets and produce more thromboxane A2. [7,8] Individuals with dyslipidemia have more tendencies to form atherosclerosis plaques with a consequent increasing consumption of platelets. We have shown preliminary results on production of larger platelets by MPV and PDW determination in a group of patients with lipid profile abnormalities. [9]

The platelet activation is measured indirectly through several platelet indices such as platelet count (PC) and platelet volume indices (PVI) such as MPV, platelet distribution width (PDW), and platelet-large cell ratio (P-LCR), which are now routinely available in most clinical laboratories at no additional cost. The early stages of atherosclerosis are accelerated by the production of mitogenic substances by platelets in response to arterial endothelial damage, such as platelets-derived growth factor (PDGF) and tumor growth factor (TGF). Platelet activation and thrombotic events are known to be brought on by hypercholesterolemia and hyperlipidemia in general. [1]

The aim of the present study was to evaluate the platelet count and platelet indices in patients with hyperlipidemia.

Materials and Methods

This was a prospective study carried out at Department of Pathology, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India for one year. The study included all patients of both sexes above 20 years of age coming to our diagnostic centre for routine health checkup. These patients underwent lipid profile testing after 12-14 hours of overnight fasting and a complete blood count as a part of their routine health checkup. 100 patients with hyperlipidemia without any associated diseases and 100 controls with normal lipid profile were included in the study.

We excluded patients with any other associated disease such as known history of coronary heart disease, diabetes mellitus or hypertension or patients receiving medications for any of these conditions as they may affect the lipid levels and platelet indices. Patients with Haemoglobin below 12.0 gm% in males and 11.0 gm% in females were also excluded from the study as anaemia is known to cause reactive thrombocytosis and may affect the platelet indices. All patients with cholesterol $\geq$ 200 mg%, triglycerides $\geq$150 mg% and HDL cholesterol $\leq$ 35 mg% were included in the study group according to the third report of the national cholesterol education programme (NCEP) and expert panel on detection , evaluation and treatment of high blood cholesterol in adults(adult treatment panel III) 2002.

Blood was collected in plain red top tubes for lipid profile and in K2 EDTA for complete blood count by standard protocol and were analysed within one hour of collection to avoid any changes in platelet indices due to prolonged storage which might affect the results. Lipid profile testing was done on Dade Dimension RxL Max (Siemens) and CBC was performed on Advia 2120 (Siemens) 5 part fully automated haematology analyser. In addition to routine CBC parameters Advia 2120 also gives platelet indices which include mean platelet volume(MPV), platelet distribution width(PDW), plateletcrit(PCT), mean platelet(component) concentration (MPC), mean platelet (dry) mass (MPM), platelet large cell count . The platelet large cell ratio (PLC-R) was calculated from the platelet count and large platelet count. Statiscal analysis was done using Pearson's correlation test and data was expressed as mean ±SD for each parameter. A p value of < 0.05 was considered to be significant.

Results

Table 1: Demographic data of patients in study group

Age	Male	Female	Total	%
21-40	22	5	27	27
41-60	37	27	64	64
61-80	5	3	8	8
>80	1	0	1	1
Total	65	35	100	100

The patients were divided into 21-40, 41-60, 61-80 and > 80 years of age in both the sexes. Maximum number of patients were in 41-60 years of age (64%) followed by 27% in 21-40 years of age, 8% in 61-80 years age group and one patient above 80 years of age.65% were male and 35% were females.

Table 2: Comparison of Patients in study and control groups

Parameter	Total	Study group	Normal Controls	P value
		Mean ± SD	Mean ± SD	
Age (in years)	200	47.3 ± 12.8	48.6 ± 12.6	
Cholesterol	200	218.6 ± 36.3	158 ± 26.8	0.72
Triglycerides	200	244.3 ± 154	94.1 ± 34.8	0.07
HDL	200	38.7 ± 9.6	42.1 ± 9.3	0.72
LDL	200	131.1 ± 39.4	97.1 ± 25.2	0.07

The mean age was 47.3 ± 12.8 in study group and 48.6 ± 12.6 in the control group. The mean cholesterol ,mean triglyceride and mean HDL cholesterol level in study group was 218.6±36.3, 244.3±154, 38.7±9.6 respectively and 158±26.8 ,94.1±34.8,and 42.1±9.3 in control group respectively. Mean LDL cholesterol was 131.1±39.4 in study group and 97.1±25.2 in control group.

Table 3: Comparison of Platelets Parameters in study and control groups

Parameter	Total	Study group	Normal Controls	P value
		Mean ± SD	Mean ± SD	
Platelets	200	320.6 ± 78.8	306 ± 76.8	0.01
MPV	200	8.5 ± 1.2	8.4 ± 0.76	0.71
PDW	200	49.7 ± 8.3	49.4 ± 8.3	0.28
PCT	200	0.28 ± 0.1	0.26 ± .07	0.0004
MPC	200	26.9 ± 1.7	26.2 ± 3.01	0.0004
MPM	200	2.17 ± 0.2	2.13 ± 0.21	0.78
Large Platelet	200	7.09 ± 4.9	5.95 ± 3.81	0.82
PLCR	200	72.9 ± 59.9	74.82 ± 67.5	0.61

There was significant difference in cholesterol, triglyceride and LDL cholesterol levels in both the groups. When platelet parameters were compared in both the groups, it was observed that the mean platelet count was 320±78.8 in study group as compared to 306±76.8 in control group. There was a significant difference in platelet counts in both groups with a p value of 0.01. PCT and MPC also showed a p value of 0.04. The mean platelet mass (MPM) was 2.17±0.2 in study group as compared to 2.13±021 in control group. Large platelet count was 7.09±4.9 in study group while it was 5.95±3.81 in control group which was also significantly different. However, the PLC-R did not show a significant difference in both groups.

Discussion

The role of hyperlipidemia as a major risk for coronary heart disease, stroke and myocardial infarction has been known since long and several studies have been conducted all over the world linking the role of increased lipids with diabetes, coronary artery disease, hypertension and obesity. [1,10-13] However, hyperlipidemia is mostly diagnosed during a regular health checkup and often goes unnoticed in the absence of any specific symptoms. Platelets and their role in haemostasis and thrombosis has been studied in great details worldwide but now the focus is on studies correlating the role of platelets in immunity and inflammation in healthy subjects as well as in diseased individuals. [14-16]

There was significant difference in cholesterol, triglyceride and LDL cholesterol levels in both the groups. When platelet parameters were compared in both the groups, it was observed that the mean platelet count was 320±78.8 in study group as compared to 306±76.8 in control group. Atherosclerosis is a major causative pathological factor for CHD and usually starts in the second decade of life due to hyperlipidemia and by the fourth decade of life manifests as CHD. Platelets are known to convert chronic atherosclerotic plaques into a thrombus causing occlusion of the arteries. [17] The platelet count is a parameter which reflects the functioning, production and ageing of the platelets. [18] MPV is used to assess the size and function of the platelets. PDW, on the other hand, is an indicator of the size distribution of the platelets and an increased PDW is considered to be an indicator of increased thrombotic tendency in individuals. [19] Large platelets have a high metabolic activity and contain more dense granules and are thus have a potential to cause platelet aggregation as compared to smaller platelets. [19,20]

In a study by Grotto et al, MPV, PDW and PLC-R were significantly higher in the hyperlipidemia patients as compared to normal controls. [21] Chih Hao Tseng et al in their study observed a significant difference in MPV, PDW and PLC-R between study and control groups and a positive correlation with LDL/HDL ratio. [22] Our study correlates with the study of Dogru et al who did not find a significant

correlation between MPV and hyperlipidemia. [23] The study by Ravindran et al did not show any significant correlation between platelet count and hypercholesterolemia. [24] There was a significant difference in platelet counts in both groups with a p value of 0.01. PCT and MPC also showed a p value of 0.04. The mean platelet mass (MPM) was 2.17±0.2 in study group as compared to 2.13±021 in control group. Large platelet count was 7.09±4.9 in study group while it was 5.95±3.81 in control group which was also significantly different. However, the PLC-R did not show a significant difference in both groups.

Conclusion

Hyperlipidemia may cause a variety of thromboembolic complications and platelet indices reported by modern day automated haematology analysers are used to assess the risk of such events in hyperlipidemic patients. Our study indicates that PCT, MPM, large platelets and platelet count are significantly higher in hyperlipidemia patients. These indices are available without any additional cost to clinicians, pathologists and patients and can be used to assess the risk associated with hyperlipidemia.

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