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Original Research Article

Adolescents with Severe Primary Dysmenorrhea Have A Unique Biomarker Called Mean Platelet Volume

Kamlesh Tiwari[1], Sadhna Singh[2], Rashmi Singh[3], Neha Savarna[4]

[1]Associate Professor, Department of Obstetrics and Gynecology, RDJM Medical College Turki, Muzaffarpur, Bihar, India

[2]Professor & HOD, Department of Obstetrics and Gynecology, RDJM Medical College Turki, Muzaffarpur, Bihar, India

[3]Professor & HOD, Department of Community Medicine, Patna Medical Collage & Hospital, Patna, Bihar, India

[4]Tutor, Department of Community Medicine, Patna Medical College & Hospital, Patna, Bihar, India

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Corresponding author: Neha Savarna

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Abstract

Objective: To determine whether mean platelet volume (MPV) is a reliable indicator of disease severity in young people with severe primary dysmenorrhea (PD).

Method: The study comprised 30 healthy teenagers with regular menstrual cycles and a total of 60 patients with PD. As part of the automated complete blood examination, hemoglobin, MPV, white blood cell (WBC), platelet, lymphocyte, and neutrophil counts were determined. The absolute neutrophil or platelet count was divided by the absolute lymphocyte count to generate the neutrophil to lymphocyte ratio (NLR) and platelet to lymphocyte ratio (PLR), respectively. The intensity of the pain was measured using the visual analog scale (VAS), which classified it as mild (30 mm), moderate (30–50 mm), and severe (>50 mm) PD.

Results: The combined severity PD and control groups' MPV levels were comparable. When compared to the control group, the MPV in the severe PD group was, however, considerably lower ($p = 0.03$). The remaining hematological parameters did not significantly differ between the groups. The mean VAS scores for the control and PD participants were, respectively, 7.34±2.24 and 1.06±1.95 ($p < 0.02$). Between MPV and WBC, there was a weak negative connection that was statistically insignificant.

Conclusion: The results of the current investigation showed that adolescents with severe PD have lower MPV. To better understand the involvement of platelets in the pathophysiology of severe PD and assess the changes in MPV value in response to treatment, additional research with larger subject populations is required.

Keywords: Primary Dysmenorrhea In Adolescence, Pelvic Pain, Mean Platelet Volume, Visual Analogue Scale.

Introduction

One of the most common gynecological conditions affecting adolescents, dysmenorrhea can lead to frequent absences from job or school [1]. Lower abdominal pain and cramps are the typical symptoms, often with headaches or nausea [2]. Primary dysmenorrhea (PD) is dysmenorrhea that doesn't have an organic

pelvic abnormality [3]. The normal onset of PD symptoms is 6–12 months after menarche, and they typically start a few hours before or after the start of monthly flow and persist for around 48–72 hours [2]. To yet, the exact cause of PD has not been determined.

Conversely, it has been hypothesised that too much prostaglandin activity can cause uterine ischemia in PD by increasing uterine contraction and uterine artery vasoconstriction [4-6]. Free radical buildup, which can result in endometrial damage and inflammation, can be brought on by ischemia [7].

A common complete blood count includes the mean platelet volume (MPV), which is a measure of platelet activity and function10. Reduced MPV levels have been linked to inflammatory burden and disease activity in a number of inflammatory diseases [8]. In addition, PD patients had lower MPV values throughout the menstrual cycle than a control group, according to a recent study. The current pilot study's objective is to determine whether MPV would be a useful measure in predicting disease severity in PD patients. This could offer a fresh understanding of the causes of this widespread illness, which could help in the development of novel treatments. [9]

Method

At Patna Medical College & Hospital, Patna, this prospective cross-sectional study was carried out. Between April 2022 and January 2023, the study was authorized by DEF's ethics committee and carried out in accordance with the principles of good clinical practice and the Helsinki Declaration. All participants signed informed consent forms. The study included adolescent girls who had regular menstrual cycles of 20–30 days and experienced PD for at least 40% of those cycles. The patient's medical history and a physical examination were used to make the diagnosis [15].

Following systematic and gynecological evaluation of the study subjects, the following exclusion criteria were applied: women who have taken medicine during the past two months and those who have used intrauterine devices: patients with a body mass index (BMI) greater than 28, patients with a pelvic disorder causing dysmenorrhea, smoking, cardiovascular disease, clinical obesity, diabetes mellitus, malignancy, hematological, hepatic, or thyroid disease, fibromyalgia, acute or chronic inflammatory diseases, any systemic disease**.**

During the first 5 days of a spontaneous menstrual cycle, blood samples were taken. Using an ethylene diamino tetra acetic acid tube and a Beckman Coulter LH 780 haematology analyzer (Beckman Coulter, Miami, Florida, USA), the automated complete blood count included measurements of haemoglobin, MPV, white blood cells (WBC), platelet, lymphocyte, and neutrophil counts. In order to prevent in vitro platelet activation, analyses were carried out right away after sample. The absolute neutrophil count or platelet count was divided by the absolute lymphocyte count to generate the neutrophil to lymphocyte ratio (NLR) and platelet to lymphocyte ratio (PLR), respectively.

The amount of discomfort was evaluated using the visual analogue scale (VAS), a validated pain scale. The actual score is calculated by measuring the distance between the patient's indicated level of pain and the left side of the 100 mm scale. Mild (30 mm), moderate (30–50 mm), and severe (>50 mm) dysmenorrhea were determined by the VAS score.

The statistical analysis was performed using the Windows version 21.0 of the Statistical Package for Social Sciences. The mean and standard deviation of all data are displayed. The distribution of the data was examined using the Kolmogorov-Smirnov test. An independent samples t-test was employed in order to identify

differences between quantitative variables. The Mann-Whitney U test for independent subgroups was used for analysis of the data that were discovered to be abnormally distributed. The Pearson's correlation test was applied for the correlation analysis. Statistics were judged to be significant at a P< 0.04.

Results

The final trial group consisted of 60 PD patients, 15 of whom had moderate PD and 38 of whom had severe PD. Age, parity, haemoglobin concentration, and BMI values did not significantly differ across the groups.

The mean VAS scores for the study and control groups were, respectively, 7.34±2.24 and 1.06±1.95 (p <0.02). While MPV levels in the study and control groups were comparable, MPV in the severe dysmenorrhea group was considerably lower than in the control group (p = 0.03; Table 1).

Table 1: Hematological characteristics of the control and PD groups

Parameter	PD Group (n=60)	Control Group (n=30)	P-value
WBC (mm^3 x 10^3)	7.68±1.84	7.67±2.15	0.937
Platelet count (mm^3 x 10^3)	263.04±72.85	278.70±54.04	0.233
Hemoglobin concentration (g/dl)	13.37±1.24	12.71±2.32	0.66
MPV (fl)	8.45±0.98	8.81±1.22	0.762
PLR	128.32±41.56	132.84±48.78	0.633
NLR	2.37±1.16	2.20±0.82	0.41
WBC stands for white blood cells. Mean platelet volume (MPV) Platelet-to-lymphocyte ratio (PLR) Neutrophil-to-lymphocyte ratio (NLR)			

The groups did not differ significantly in terms of WBC, platelet count, NLR, or PLR. Between MPV and WBC, there was a weak negative connection that was statistically insignificant [Table 2].

Table 2: Hematological parameters between groups with severe PD and controls are compared.

Parameter	PD Group	Control Group	P-value
MPV	8.25±0.91	8.81±1.22	P= 0.03
PLR	133.31±42.01	132.84±48.78	P>0.04
NLR	2.38±1.21	2.20±0.82	P>0.04

Discussion

The current study findings showed that adolescents with severe PD had considerably lower MPV values than healthy controls. There was no discernible connection between MPV, NLR, PLR, and WBC. This study is the first in the body of literature to demonstrate a link between teenage severe PD and MPV values. [10]

PD is a widespread illness that can impact up to 45% to 95% of young women [12] and is linked to significant financial costs and social issues. The failure rate of the standard PD treatment is between 20 and 25 percent [13]. The bulk of current therapy options try to lower prostaglandin levels, and oral contraceptives and nonsteroidal anti-inflammatory medications are most frequently used to treat PD [14]. Although being linked to its aetiology, not all PD patients have elevated levels of prostaglandins in their serum or menstrual fluid [15].

Many investigations have noted that PD also results in the overproduction of vasopressin in addition to prostaglandins . Uterine contractions brought on by elevated myometrial activity could be the cause of the discomfort in PD. The

endometrial inflammation that results from the resulting ischemia may be what causes the platelet activation.

A full blood count can simply and inexpensively provide MPV, a measure of platelet function and activation. MPV has been linked to disease activity and the intensity of inflammation, and numerous studies have identified it as a helpful marker for some inflammatory disorders.

Low MPV values were seen in pelvic inflammatory illness, and Incebiyik et al work highlighted its diagnostic relevance [16]. Rheumatoid arthritis, ankylosing spondylitis, and ulcerative colitis have all been linked to decreased MPV levels [17]. Similar to the earlier research, the current investigation found reduced MPV levels in patients with severe dysmenorrhea; however, MPV values were unaffected by mild or moderate dysmenorrhea. Hence, changes in the MPV number may be helpful for determining the severity of the disease and may also be a sign of how well the treatment is working.

Platelets are essential for controlling inflammation. As soon as inflammatory mediators are produced, platelet activation increases and MPV levels shift as a result [18]. Reduced MPV levels have been seen in severe PD, which may have a possible reason related to platelet consumption at the site of inflammation. Furthermore, megakaryopoiesis can be impaired by an inflammatory environment with increased acute phase reactants in PD, which can lead to the release of tiny platelets from the bone marrow. This may indicate that platelets are important in the aetiology of Parkinson's disease, and MPV levels may therefore indicate how severe the disease is. When participants were not divided into groups based on the severity of their PD, there were no differences in MPV levels between the adolescents with PD and the control groups in the current study. This is in contrast to a recent study by Soydinc et al. that found decreased MPV levels at each phase of the menstrual cycle in PD [19].

Although this preliminary study has certain limitations, the findings may provide insight into the development of Parkinson's disease. The sample size was somewhat limited, and the effects of the therapy on MPV levels were not examined.

However, we found that MPV levels are lower in adolescents with severe PD, but not mild or moderate PD, as compared to healthy controls in this investigation to assess changes in haematological parameters in adolescents with PD. To completely understand the function of platelets in the pathophysiology of severe dysmenorrhea and to assess the changes in MPV values after treatment, when the severity of dysmenorrhea is reduced, more research with bigger sample numbers is necessary.

Conclusion

The results of the current investigation showed that MPV is reduced in young people with severe PD. To better understand the involvement of platelets in the pathophysiology of severe PD and assess how therapy affects MPV values, additional research involving larger subject populations is required.

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