

Assessing the mean platelet volume in hypertensive patients of Hyderabad, Sindh: a cross-sectional study

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ABSTRACT

Background: Hypertension is a renowned silent killer, which slowly and gradually destroys vital organs of the body without any clinical manifestations. Every year around 9 million people die due to complications of hypertension including Myocardial Infarction, Stroke, Heart Failure and Renal Failure. Mean platelet volume is an emerging biomarker of inflammation which can indicate the presence and severity of an underlying pathology. Due to its easy availability and low cost it is a preferred marker for assessment of inflammation.

Objective: To evaluate the effects of hypertension on mean platelet volume.

Materials & Methods: A hospital-based cross-sectional study was conducted in Muhammad Medical College Hospital, Mirpur Khas, Sindh, from January 2023 to March 2024 on 385 subjects through convenience sampling. Blood pressure was measured twice, two hours apart of every subject and blood samples of all were sent to laboratory for assessment of mean platelet volume. Statistical analysis was conducted on MS Excel and GraphPad Prism 9. Descriptive statistics were performed with $p \leq 0.05$ taken as significant.

Results: The study results show that 170 participants (44.15%) who were hypertensive had raised MPV in comparison to normal population. The p-value of 0.034 indicates a statistically significant difference between the groups.

Conclusion: A significant association was found between raised MPV and hypertension as compared to non-hypertensive subjects.

Keywords: Hypertension; Blood Platelets; Thrombosis; Hematology; Endothelium.

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INTRODUCTION

Hypertension is one of the major causes of human morbidity and mortality. There are different causes of hypertension including genetically from parents, stress, anxiety, endocrinological, and vascular disorders.¹ In hypertension excessive pressure by the column of blood on the vascular endothelium leads to inflammation of endothelium. This leads to platelet aggregation, their activation, release of various precursors and increase in the size of the platelets in order to plug the dent.² Platelets are the blood cells which are concerned with the repair of the damaged endothelium, but their excess activity may lead to athero-thrombotic complications. There are both small and large platelets present in the blood; as the size of the platelets increases, the thrombotic accidents increase, leading to cardiovascular complications.³ Platelets aggregate at the site of endothelial injury and secrete many vasoconstrictor and thrombotic agents as a protective mechanism against blood loss.⁴ Mean Platelet Volume (MPV) is the marker that rises in inflammatory conditions.⁵ An estimation of MPV is a new trend in diagnosis and prognosis of the level of hypertension.⁶ There are various factors which increase the mean platelet volume, including raised glycemic level, hypertension, smoking, and lipid profile abnormalities.⁷ Previous researches have shown that MPV has a special association with hypertension. This was the reason why aspirin was added to the treatment of hypertension to avoid the thrombotic complications of hypertension.⁸ MPV is an important investigation which may be helpful to keep an eye on the progression of hypertension and its complications.⁹ The standard reference range of Mean Platelet Volume in a healthy individual is from 7 to 11 femtoliter (fl).¹⁰ The aim of this study is to find any significant relationship between Hypertension and Mean platelet Volume (MPV).

The rationale of this study is to investigate the relation between hypertension and MPV as hypertension is a rapidly prevailing major cardiovascular and cerebrovascular accidents risk factor; without this research early detection of hypertension induced complications and good preventive measures may become overlooked.

MATERIALS & METHODS

This cross-sectional study was accomplished according to the Helsinki's declaration in Muhammad Medical College Hospital, Mirpur Khas, Sindh, from January 2023 to March 2024 after getting ethical approval from institute's ethical committee vide letter no MMC 362. Informed consent was provided to all the study participants, and the procedure of study was also explained to them. The identity and data of all participants were kept confidential.

Initially 400 individuals were selected for study; during initial screening 4 had history of previous Myocardial infarction, 6 were on anti-coagulation drugs, and 5 had deranged urea/creatinine levels. After excluding these, 385 participants were included in the study, in which 271 were males and 114 were females. Participants between ages of 20-45 years were included whereas Participants with positive pregnancy test, cerebrovascular, metabolic, liver and kidney diseases were excluded from study. All participants were seated in a quite comfortable environment for about 10 minutes after which their blood pressure was measured by a manual sphygmomanometer. Readings were taken twice with an interval of 2 hours. On the basis of blood pressure (BP) readings, the participants were divided into two groups, Group A with BP less than 140/90 and Group B with BP more than 140/90.

Around 5ml of deoxygenated blood sample was taken from cubital vein into EDTA containing collection tube. The blood

sample was then sent to laboratory for the analysis of mean platelet volume where it was placed inside a blood analyzer machine (Sysmex XN-3000, Japan).

The reference level of blood pressure was taken from the guideline of World Health Organization (WHO) which states that systolic blood pressure more than 140 mmHg and diastolic blood pressure more than 90 mmHg (WHO) and normal range of MPV was 6.8 to 10.8 femtoliter(fl).

RESULTS

Table 1 shows the demographic data of the sample. The mean age of the hypertensive male participants was 35.92 ± 5.54 years, and non-hypertensive male participants 32.8 ± 7.72 years; mean ages of hypertensive and non-hypertensive females were 35.12 ± 5.06 years and 30.79 ± 7.07 years respectively. The mean BMI of hypertensive and non-hypertensive males were 21.93 ± 2.88 and 21.93 ± 2.91 , while the mean BMI of hypertensive and non-hypertensive female were 20.82 ± 1.68 and 22.08 ± 2.86 respectively. The mean systolic BP of hypertensive males was 143.0 ± 8.03 mmHg and those of non-hypertensive male was 110.2 ± 5.99 mmHg; for hypertensive females, it was 136.6 ± 5.93 mmHg and for non-hypertensive females, it was 106.3 ± 7.48 mmHg. The mean diastolic BP of hypertensive males was 93.28 ± 6.36 mmHg, and of non-hypertensive males was 69.54 ± 5.68 mmHg; for hypertensive females, it was 94.16 ± 5.97 mmHg, and for non-hypertensive females it was 67.77 ± 7.20 mmHg.

Table 1: Comparison of demographic and physical parameters between hypertensive and non-hypertensive subjects (n=385).

Parameters	Hypertensive (n=170)	Non Hypertensive (n=214)
Mean Age (years)		
Male	35.92 ± 5.54	32.84 ± 7.72
Female	35.12 ± 5.06	30.79 ± 7.07
BMI		
Male	21.93 ± 2.88	21.93 ± 2.91
Female	20.82 ± 1.68	22.08 ± 2.86
Mean Systolic Blood Pressure (mmHg)		
Male	143.0 ± 8.03	110.2 ± 5.99
Female	136.6 ± 5.93	106.3 ± 7.48
Mean Diastolic Blood Pressure (mmHg)		
Male	93.28 ± 6.36	69.54 ± 5.68
Female	94.16 ± 5.97	67.77 ± 7.20

Table 2 compares the MPV levels in non-hypertensive and hypertensive female and male. Hypertensive male and female had higher rates of raised MPV (71% and 68% respectively) compared to non-hypertensive male and females (30% and 25%

respectively) The correlation coefficient is 0.9315, p-value of 0.0343, indicating a significant relationship between raised MPV and hypertension.

Table 2: Comparison of Mean Platelet Volume (MPV) in hypertensive and non-hypertensive participants (n=385).

Participants	MPV Levels f(%)		p Value	Correlation Coefficient
	Normal Level of MPV	Raised MPV (>12.0fl)		
Non Hypertensive Male Participants (N=102)	72(18.7%)	30(7.8%)	0.0343	0.9315
Non Hypertensive Female Participants (N=40)	30(7.8%)	10(2.6%)		
Hypertensive Male Participants (N=169)	49(12.7%)	120(31.2%)		
Hypertensive Female Participants (N=74)	24(6.2%)	50(12.99%)		
Total	175(45.4%)	210(54.54%)		

DISCUSSION

This study investigates the relationship between raised MPV and hypertension. The study results show that the sample size of this study was 385 participants, of whom 142(36.9%) were placed in the control group and another 243(63.11%) were placed in the case group. The statistical data show that 210(54.54%) participants had raised MPV among 385(100%) participants and among them 120(31.16%) male participants were hypertensive and 50(12.98%) were female participants. These results were further supported by p value of 0.03, correlation coefficient 0.93, standard deviation of differences 9.6, standard error of mean of differences around 4.8.

These study results align with the results of other researchers. Study conducted by Pusuroglu H, et al.,¹¹ showed that there is obvious relationship between elevated MPV and hypertension with significant adverse cardiovascular outcome in the studied population ($p < 0.001$). The study of Akin H, et al.,¹² also found that MPV value were significantly elevated in participants with resistant hypertension compared to normal population ($p < 0.05$). Ding Q, et al.,¹³ also found elevated MPV in hypertension and metabolic syndrome with p value < 0.01 . Jian ZW, et al.,¹⁴ found that markers of endothelial injury were highly elevated in hypertensive patients with elevated MPV ($p < 0.01$). Sileshi B, et al.,¹⁵ showed that hypertensive participants had elevated MPV levels compared to normotensive individuals ($p < 0.001$). But there is another group of authors that oppose these results. Li T, et al.,¹⁶ and Kutlugun AA, et al.,¹⁷ showed that there is no significant association between elevated MPV and hypertension

compared to normotensive participants with ($p > 0.05$). Yildiz I, et al.,¹⁸ found no difference in levels of MPV among hypertensive and non-hypertensive participants ($p > 0.05$). Venkatesh M, et al.,¹⁹ also stated that there is no significant correlation between pulmonary hypertension and MPV in COPD patients with ($p > 0.05$).

CONCLUSION

A significant relationship exists between raised MPV and hypertension in comparison to non-hypertensive subjects.

RECOMMENDATIONS

More researches all around the globe among different ethnicities are required to confirm the validity of results and generalization around the world. Clinicians should use MPV assessment routinely in hypertensive populations for improved management strategies.

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LIMITATIONS

There are certain limitations to this study. First, it was a cross sectional study; secondly, the sample size was small. Thirdly, this study was conducted in one hospital, so the results cannot be applied to the whole population and fourthly, the presence of unknown confounding variables.

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