A Study Of Mean Platelet Volume And Its Relationship With Hypertensive Retinopathy In Hypertensive Patients.

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ABSTRACT

Hypertensive retinopathy (HR) represents the ophthalmic findings of end-organ damage secondary to systemic arterial hypertension. Platelets play a crucial role in the pathogenesis of atherosclerotic complications, contributing to thrombus formation or apposition after plaque rupture. The aim of our study was to investigate whether Mean platelet volume (MPV) is associated with the severity of hypertensive retinopathy in hypertensive patients. This is a prospective study done from Jan 2022 to Dec 2022 at Govt. Vellore Medical College, Vellore. This study group included 100 patients with essential hypertension with hypertensive. Retinopathy of all ages and of both sexes. The mean platelet volume was found to be normal (≤10 fl) in 71 patients (71%), among them 42 were males and 29 were females. Elevated levels of mean platelet volume (>10 fl) were found in 29 patients (29%), of these 13 were males while 16 were females. Among patients with elevated mean platelet volume, grade 1 hypertensive retinopathy have mean of MPV of 10.9 fL. In grade 2,3 and 4 hypertensive retinopathy, the values were 11.03, 11.56 and 12.2 fL respectively. This study concluded that frequency of mean platelet volume is increased in patients of hypertensive retinopathy and mean platelet volume increases with increasing the severity of hypertensive retinopathy
Keywords: Atherosclerosis, Hypertension, Platelets, Retinopathy

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INTRODUCTION

Hypertension is one of the most common worldwide diseases and is a major risk factor for stroke, myocardial infarction, vascular disease, and chronic kidney disease [1]**.** Hypertension is associated with increased cardiovascular risk leading to systemic end-organ damage, including retinopathy. Prevalence of hypertensive retinopathy amonghypertensive patients is quite high, seen in both sexes and almost in all age groups. It increases with duration of the disease and is maximum in patients with duration of 10 years or more [2]. The pathophysiological mechanism of hypertensive retinopathy is not fully established. In hypertensive retinopathy, elevated blood pressure alone does not fully account for the extent of retinopathy, so other pathogenic mechanisms may be involved, such as increased platelet activation Platelets play a crucial role in the pathogenesis of atherosclerotic complications, contributing to thrombus formation orapposition after plaque rupture [3]. Platelets normally circulate in a quiescent disc shaped state and as they activate, they undergo a disc to sphere transformation with the development of pseudopodia, causing a subsequent increase in size. So, mean platelet volume (MPV) is a marker of platelet activation and platelet function, i.e., large platelets contain more dense granules and produce more thromboxane A2 [4]. Normal range for MPV is given as 7.5-11.5 Fl Elevated MPV levels have been identified as an independent risk factor for myocardial infarction, diabetes, hypercholesterolemia, smoking and in patients with renal artery stenosis. Patients with larger platelets can easily be identified during routine haematological analysis and could possibly benefit from preventive treatment. Thus, MPV is an important, simple, effortless, and cost-effective tool that should be used and explored extensively, for predicting the possibility of vascular complications [5, 6]. Our study aims in detection of hypertensive retinopathy by using MPV, a cheap routine test, as an indicator of hypertensive retinopathy. This study will help us to identify hypertensive retinopathy which is a commonly ignored complication of hypertension among the known essential hypertensive patients, so that early measures can be taken to prevent this complication.

METHODOLOGY

This is a prospective study done from Jan 2022 to Dec 2022 at Govt. Vellore Medical College, Vellore. This study group included 100 patients with essential hypertension with hypertensive. Retinopathy of all ages and of both sexes.

Inclusion criteria

Known essential hypertensive patients of all ages and both sexes withhypertensive retinopathy.

Exclusion criteria

- Diabetes mellitus (fasting blood sugar>126 mg/dl) Dyslipidemia
- Obesity (BMI>30kg/m2)
- Recent major surgery or illness within last 6 monthsThyroid disorders
- Infection
- Hemoglobin<13g/dl in males, <12g/dl in females. Thrombocytopenia (platelet count <1.5 lakhs/cumm)
- Blood malignancies
- Serum creatinine>1.4 mg/dl in males&>1.1 mg/dl in females
- Patients on drugs affecting platelet function (heparin, aspirin, clopidogrel,warfarin)

Data collection procedure:

Informed consent was obtainedfrom all the subjects. All of them gave detailed history and patient with history of recent major surgery or illness in the last 6 months and pts with history of present illness were cautiously excluded. Patients with history of using the drugs affecting platelets functions were excluded. All patients were undergoing weight (kg) and height (m) measurements for the calculation of body mass index (BMI=kg/m2) and patients with body mass index of more than 30 kg/m2 are also excluded from the study. All patient'sarterial BP was recorded with a mercury sphygmomanometer after the patient had taken 5 minutes of rest. Two readings were taken for each subject and the average of two readings were obtained. Hypertension was defined as systolic blood pressure ≥140 mmHg or diastolic

blood pressure ≥90 mmHg.The patients were called back and blood samples after a fasting period of 12 hours. Fasting lipid profile, fasting blood glucose, fasting thyroid profile hemogram and renal function profile were done. Patients with dyslipidemia(HDL <40 or >60 mg/dl, LDL >100 mg/dl, triglycerides >150 mg/dl or total cholesterol >200 mg/dl), diabetes (fasting blood sugar >126 mg/dl), thyroid disorder (TSH <0.4 or >4.5 mIU/L), anaemia (Hemoglobin<13g/dl in males, <12g/dl in females), thrombocytopenia (platelet count <1.5 lakhs/cumm), renal failure(Serum creatinine>1.4 mg/dl in males and >1.1 mg/dl in females) were cautiously excluded from the study. Blood samples were collected in citrate (1:4 v/v) in order to reduce platelet swellings, induced by EDTA. The test was performed in the autoanalyser within 30 minutes after collection of samples to reduce the variation in results due to samples ageing. For evaluation of hypertensive retinopathy, direct ophthalmoscopic examination will be performed after dilatation of pupil with 1% tropicamide eye drops. Patients were classified into grades of hypertensive retinopathy according to Keith Wagener classification.

Data analysis

Statistical analysis was done by using SPSS-12 version. The quantitative variables were presented as Mean ± SD i.e. age and mean platelet volume. Frequency and percentages were presented for categorical variables i.e. gender and grades of hypertensive retinopathy. One way ANOVA test was used to compare mean platelet volume in all grades of hypertensive retinopathy.

RESULTS

The collected data were analysed with IBM.SPSS statistics software 23.0 Version. To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables. To find the significance in categorical data Chi-Square test was used similarly if the expected cell frequency is less than 5 in 2×2 tables then the Fisher's Exact was used. In both the above statistical tools the probability value .05 is considered as significant level. A total number of 100 patients who were known cases of essential hypertension with variable degrees of hypertensive retinopathy were included in the study. These patients were distributed in 5 different age groups. Group 1 (31-40years) had 3 patients (3%), group 2 (41-50 years) had 41 patients (41%), group 3 (51 -60 years) had 22 patients (22%), group 4 (61-70 years) had 27 patients and group 5 (71-80 years) had 7 patients (7%). This showed a maximum distribution of patients of hypertensive retinopathy in age 41-70 years.

The mean platelet volume was found to be normal (≤10fL) in 71 patients (71%), among them were 42 males and 29 females. Elevated levels of mean platelet volume (≥10fL) were found in 29 patients (29%), among them were 13 males and 16 females. All patients were examined by direct ophthalmoscopy and were classified in 4 different grades of hypertensive retinopathy, according to Keith Wagener classification. Patients of grade 1 retinopathy were 44 patients (44%) in total while those of grade 2,3 and 4 were 42 patients (42%), 10 patients (10%) and 4 patients (4%) respectively. This data showed that the maximum number of patients were falling in grade 1 and 2 hypertensive retinopathy (86%). Patients with grade 4 hypertensive retinopathy constituted a very small group (4%). The study was used to asses the hypothesis of frequency of mean platelet volume increases with the increase in the degree of hypertensive retinopathy. This test showed $p < 0.05$ which shows statistically significant association between hypertensive retinopathy stage and mean platelet volume. Among patients with elevated mean platelet volume, grade 1 hypertensive retinopathy have mean range of mean platelet volume of 10.9 fL. In grade 2,3 and 4 hypertensive retinopathy, the values were 11.03,11.56 and 12.2 fL respectively. These progressively increasing mean values of the mean platelet volume in different grades of hypertensive retinopathy also strengthens the hypothetical statement. In grade 1 hypertensive retinopathy, 36 patients (50.7%) had normal mean platelet volume and 8 patients (27.6%) have elevated mean platelet volume. Similarly in grade 2,3 and 4 hypertensive retinopathy patients, 12 (41.4%), 6 (20.7%) and 3 (10.3%) patients respectively had elevated mean platelet volume.
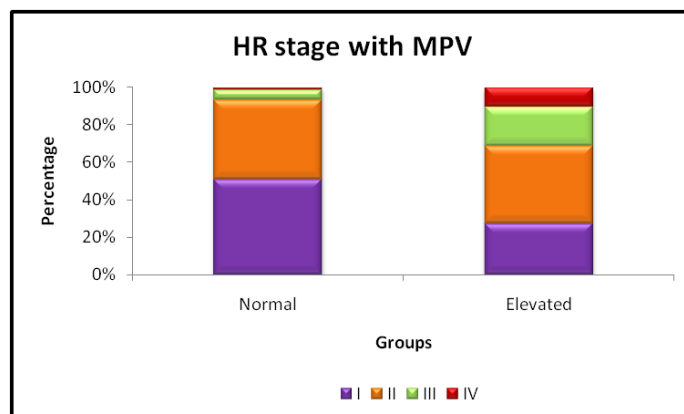
Figure 1: Age distribution
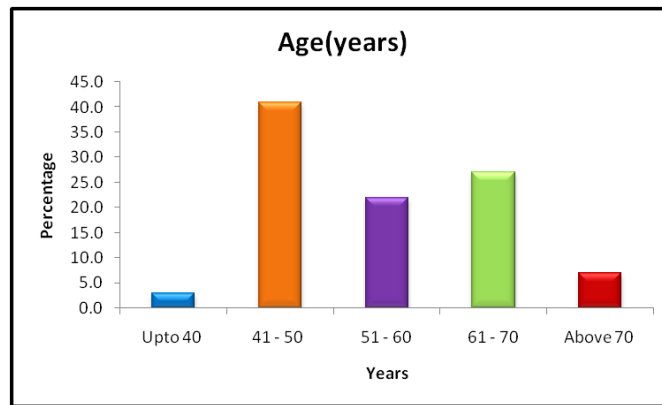
The above Graph shows Age distribution were 3.0% is up to 40 years, 41.0% is 41-50 years, 22.0% is 51-60 years, 27.0% is 61-70 years, 7.0% is Above 70years.

Figure 2: Mean MPV
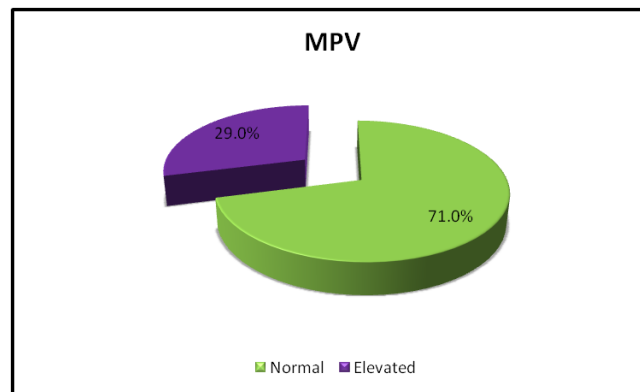
The above graph s h o w s MPV distribution were 71.0% is Normal, 29.0% is Elevated.
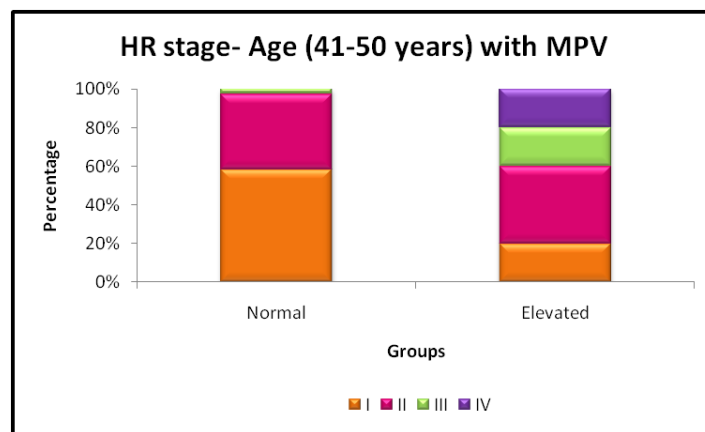
Figure 3: HR Stage With MPV

The above graph shows comparison between HR stage with MPV by Pearson's chi-squared test were x^2=11.283, p=0.010<0.05 which shows statistically significant association between HR stage and MPV.

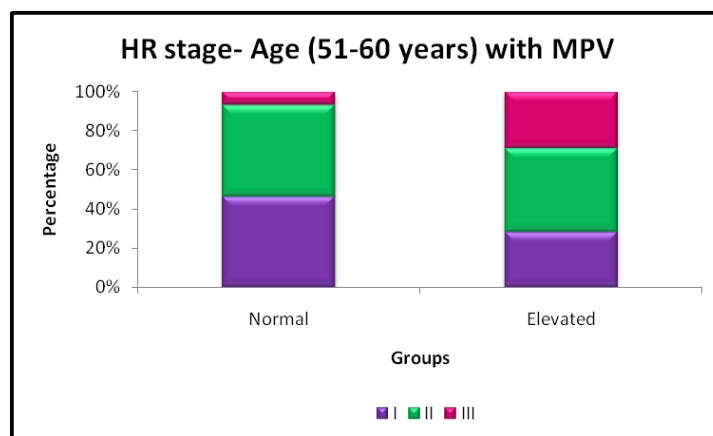**Figure :4 Comparison between HR stage- Age (Up to 40 years) with MPV**
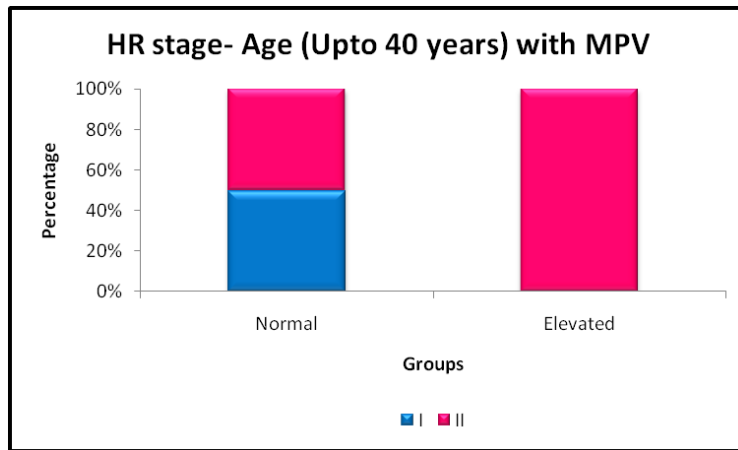
The above graph shows comparison between HR stage- Age (Up to 40 years) with MPV by Pearson's chi-squared test were x^2=0.750, p=1.000>0.05 which shows no statistically significant association between HR stage- Age (Upto 40 years) and MPV.

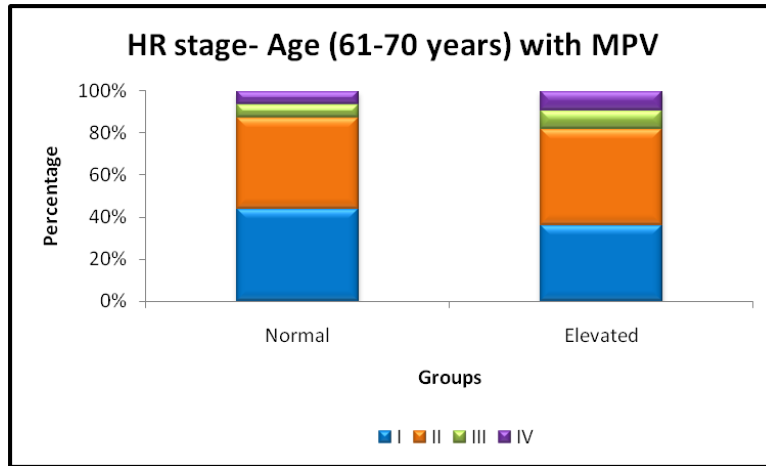**Figure 5: Comparison between HR stage- Age (41-50 years) with MPV**

The above figure shows comparison between HR stage- Age (41-50 years) with MPV by Pearson's chi-squared test were x^2=11.073, p=0.011<0.05 which shows statistically significant association between HR stage- Age (41-50 years) and MPV.

Figure 6: Comparison between HR stage- Age (51-60 years) with MPV

The above figure shows comparison between HR stage- Age (51-60 years) with MPV by Pearson's chi-squared test were x^2=2.077, p=0.354>0.05 which shows no statistically significant association between HR stage- Age (51-60 years) and MPV.

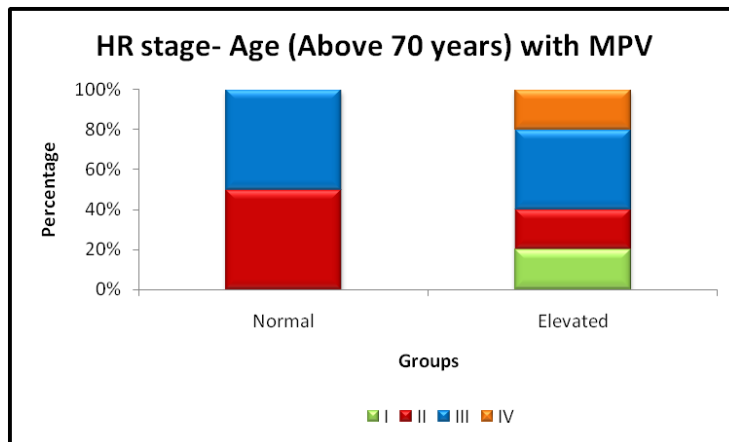**Figure 7: Comparison between HR stage- Age (61-70 years) with MPV**

The above figure shows comparison between HR stage- Age (61-70 years) with MPV by Pearson's chi-squared test were x^2=0.234, p=0.972>0.05 which shows no statistically significant association between HR stage- Age (61-70 years) and MPV.

Figure 8: Comparison between HR stage- Age (Above 70 years) with MPV

The above figure shows comparison between HR stage- Age (Above 70 years) with MPV by Pearson's chi-squared test were x^2=1.283, p=0.733>0.05 which shows no statistically significant association between HRstage- Age (Above 70 years) and MPV.

DISCUSSION

Hypertensive retinopathy is among the vascular complications of essential hypertension. It is known that the autoregulation of retinal circulation fails as blood pressure increases beyond a critical limit however elevated blood pressure alone does not fully account for the extent of HR [7]. Platelet activation, a mechanism known to be involved in vascular lesions, may promote the development of hypertensive retinopathy. Thus, the presence of high MPV levels in HR and the correlation of the increased MPV with the severity of HR imply that MPV may be involved in the mechanism of HR [8]. Measurement of mean platelet volume is an easy, cheap and affordable test of platelet activation thus can used as a potential tool for screening microvascular complications in hypertensive patients [9]. We conducted this study after getting consent from the patients, hypertensive patients were selected after being cautiously applying our exclusion and inclusion criteria. Direct ophthalmoscopy was performed in those patients and 100

hypertensive patients were selected [10]. Blood samples were collected in citrate (1:4 v/v), induced by EDTA for the measurement of mean platelet volume. The test was performed in the autoanalyser within 30 minutes after collection of samples [11]. In our study, The mean platelet volume was found to be normal (≤10 fl) in71 patients (71%), among them 42 were males and 29 were females. Elevated levels of mean platelet volume (>10 fl) were found in 29 patients (29%), of these 13 were males while 16 were females [12]. Among patients with elevated mean platelet volume, grade 1 hypertensive retinopathy had mean MPV of 10.9 fl. In grade 2,3 and 4 hypertensive retinopathy, the values were 11.03, 11.56 and 12.2 fl respectively. We conclude that frequency of mean platelet volume is increased in patients ofhypertensive retinopathy and mean platelet volume increases with increasing severity of hypertensive retinopathy. Thus, the presence of high MPV levels in HR and the correlation of the increased MPV with the severity of HR imply that MPV may be involved inthe mechanism of HR [13-15].

CONCLUSIONS

This study concluded that frequency of mean platelet volume is increased in patients of hypertensive retinopathy and mean platelet volume increaseswith increasing the severity of hypertensive retinopathy. The presence of high mean platelet volume levels in hypertensive retinopathy and the correlation of the increased mean platelet volume with severity of hypertensive retinopathy imply that mean platelet volume may be involved in the mechanism of hypertensive retinopathy.

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