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Original Research Article

A COMPARATIVE ASSESSMENT OF SOME HAEMATOLOGICAL PARAMETERS AMONG NORMOTENSIVE AND HYPERTENSIVE SUBJECTS

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ABSTRACT

Background: Hypertension is the most common problem worldwide. It can lead to cardiovascular diseases like stroke, congestive heart failure, thickening of heart muscles and also lead to functional disturbances including haematological parameters. The abnormalities of haematological parameters may enhance end organ damage. The Aim & Objective is to compare and assess haematological parameters in hypertensive and normotensive subjects & to study the effect of hypertension on haematological parameters. **Materials and Methods:** Total 100 subjects – 50 normotensives and 50 hypertensives with age group 35 – 65 years from department of medicine in P.D.U. Govt. Medical College and Hospital were included in this laboratory based cross sectional study. After taking informed consent of all subjects, detailed history was taken and Blood Pressure was measured by using a mercury sphygmomanometer in supine position. 2 ml of venous blood was collected in Ethylenediaminetetraacetic acid (EDTA – anticoagulant) Vaccutainer. CBC count was analysed by using Nihon Kohden MEK – 6510K Automated Haematology Analyzer. Data was tabulated and analysed. Standard error of difference between two mean was taken. The data between two groups were compared by Student t-test. All statistical analysis was done by using Epi Info software and Microsoft Excel. **Results:** The mean values of Haemoglobin, RBC Count, WBC Count and PCV (Hct) were found to be significantly higher in primary hypertensive study group as compared to normotensive group while the mean value of MCV was detected to be significantly lower in hypertensive group as compared to normotensive group. The mean value of Platelet count and MCHC was higher whereas MCH was lower in hypertensive group as compared to normotensive group but there was no statistically significant difference. **Conclusion:** Assessment of haematological parameters may be a used as predictor of coronary artery diseases. It is advised to the hypertensive patients to get their haematological parameters checked regularly and should be assessed by the treating physician for any derangement and thus preventing future cardiovascular complications.

INTRODUCTION

In today's world, Hypertension is a general medical condition that significantly increases the risk of heart, brain and kidney related diseases. An estimated 1.28 billion adults aged 30-79 years have hypertension world-wide, mostly two-thirds people living in developing countries. Approximately 46% of adults with hypertension are not aware that they have this condition. Around 42% adults with hypertension are diagnosed and treated. Approximately 21% adults (1 in 5) with hypertension have it under control. Hypertension is a crucial cause of premature death worldwide. One of the Global targets of WHO for noncommunicable diseases is to reduce the prevalence of hypertension by 33% between 2010 and 2030.[1]

Nowadays, Hypertension is an epidemic condition. In an analysis of worldwide data for global burden of hypertension, 20.6% of Indian men and 20.9% of Indian women were diagnosed with hypertension in 2005.The rate for hypertension was projected to increase up to 22.9% and 23.6% for Indian men and women respectively by 2025.[2]

High blood pressure is one of the major risk factors for universal mortality and is estimated to have

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caused 9.4 million deaths and 7% of disease burden – as measured in Disability Adjusted Life Years (DALYs) − in 2010.[3] Raised blood pressure is the leading cardiovascular risk factor, if not controlled then it may lead to blindness, dementia, renal failure, myocardial infarction, cardiac failure and even stroke causing human suffering and imposing severe economical burdens on health system. Scientific studies have consistently shown the health benefits of reduction in blood pressure through population-wide and individual interventions (behavioral and pharmacological). For instance, decrease in systolic blood pressure by 10 mmHg is associated with 22% reduction in coronary heart disease and 41% reduction in stroke in randomized controlled trials.[4]

In present days, most population has acquired sedentary lifestyles, poor dietary habits, high stress level and reduced physical activity. All these factors are responsible for high incidence of hypertension in population.

Hypertension for long period develops atherothrombotic disease. Atherothrombotic diseases are utmost healthcare issue and are responsible for >25% of all deaths worldwide.[5]

Hypertension is a serious health problem worldwide that affects 20–30% of the adult population.[5] Genetic and environmental factors like age, sex, high body mass index (BMI), hyperlipidemia, diabetes, alcohol drinking, sodium intake and others were found to be related with hypertension.

Hypertension is associated with functional and structural abnormalities in organs that involve in haematopoiesis and blood viscosity is increased in most of hypertensive patients.[6] However, the details of this connection is not clear, development of hypertension is assisted by decrease in deformability and increase in size, number and aggregability of red blood cells. These abnormalities of the red cells may impair the microcirculation and lead to end-organ damage.[7]

On the other hand, Hypertension has an effect on haematological parameter such as haematocrit (PCV), Haemoglobin(Hb), Red Blood Cell(RBC) Count, White Blood Cell(WBC) Count and Platelet Count. Impaired haematological parameters may strongly suggest hypertensive end-organ damage, specifically kidney failure.[6] Generally, there are inconsistent results about haematological parameters of hypertensive patients in different countries.

Aims and Objectives

1. To assess and compare haematological parameters in hypertensive and normotensive subjects.
2. To study the effect of hypertension on haematological parameters.

MATERIALS AND METHODS

The present study was conducted during year 2021-22. The study has been approved by the Institutional Ethics Committee at P.D.U. Government Medical College, Rajkot number PDUMCR/IEC/53/2021, dated 23rd March 2021.

Study design: Laboratory based cross-sectional study

Total 100 subjects - 50 primary hypertensive patients were taken as study group and 50 normotensives were taken as control group. They were selected from outpatient clinics of medicine department, P.D.U. Govt. Medical College and Hospital, Rajkot.

Inclusion criteria:

Study group –

Age: 35 - 65 years

Sex: Males & Females

Hypertensive subjects having Blood pressure: ≥140/90mmHg with the history of previously diagnosed hypertension >1 year duration, or taking antihypertensive medications and cause of hypertension is idiopathic.

Control group –

Age: 35 - 65 years

Sex: Males & Females

Normotensive subjects having Blood pressure: ≤120/80mmHg

Exclusion criteria

For Study and Control group

- Subjects with history of infectious diseases, SLE, RA and patients with major systemic illness like diabetes mellitus, hypo/hyperthyroidism, chronic kidney disease, CHD, cerebrovascular disease, hepatic disease, malignancy and haemolytic anemia like sickle cell, thalassemia & haematopoietic disorders.
- Treatment with chemotherapy.
- Any present illness, acute infection in last 6 months (typhoid, malaria, pharyngitis etc.), acute coronary syndrome, etc.
- Using medical treatment which affect WBC Count like haematopoietic disorders
- History of using glucocorticoid therapy in past 3 months.

Methodology

The protocol was explained to all subjects of both groups, who volunteered for study. Informed consent was obtained from all participants. A detailed history of both hypertensives and normotensives were taken and the physiological parameters like height(measured by standing barefoot in erect position with a wall-mounted stadiometer), weight(measured by standing steady on a weighing scale), pulse rate(measured by palpation with three fingers on radial artery after 5 min. rest in sitting position), blood pressure were recorded.

Blood pressure was measured in any arm using a mercury sphygmomanometer and stethoscope, after 5 min. rest in sitting position. Highest of two reading was taken as correct systolic and diastolic BP. Both general and systemic examination were done thoroughly.

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After taking detailed history and recording of above parameters, 2 ml of venous blood was collected in Ethylenediaminetetraacetic acid (EDTA – anticoagulant) Vaccutainer by experienced person from each study subjects. Then CBC Count was analysed by using Nihon Kohden MEK – 6510K Automated Haematology Analyser in pathology laboratory of P.D.U. Government Medical College and Hospital, Rajkot.

Quality Assurance: Protocol for sample collection, processing and transportation was strictly followed to have safe procedure and reliable specimen. Quality controls and standard operating procedures was strictly followed for haematological parameter analysis. The results was properly documented, composed and reviewed.

Data Analysis: The physiological parameters like height, weight, pulse rate, blood pressure were recorded. Haemoglobin, RBC Count, WBC Count, Platelet Count, Haematocrit – These were taken from the blood reports. Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) were calculated from known value of Hb, RBC Count and PCV. Data represented as Mean+SD. The data between two groups were compared by Student t-test. P value <0.05 were considered as statistically significant and <0.01 were considered as highly significant. All statistical analysis was done by using Epi Info software and Microsoft Excel.

RESULTS

The study was carried out on 50 primary hypertensive and 50 normotensive healthy individuals. Male subjects and Female subjects ratio is equal in both study group and control group.

Table 1: Comparison of age, height, weight and BMI between study group and control group

	Study group	Control group	P value
Age (year)	42.76 ± 3.97	41.48 ±4.25	> 0.05
Weight (kg)	62.62 ± 7.14	62.46 ± 7.19	> 0.05
Height (m)	1.62 ± 0.07	1.61 ± 0.07	> 0.05
BMI (kg/m^2)	23.79 ± 1.48	24.11 ± 1.67	> 0.05

Body Mass Index (BMI) was calculated by following formula:
Body mass index = weight (kg)/ height (m)2.[8]

Table 2: Pulse, Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Pulse Pressure (PP), Mean Arterial Pressure (MAP) in study group and control group

	Study group	Control group	P value
Pulse (rate/min.)	71.28 ± 5.28	75.88 ±5.17	<0.01
Systolic Blood Pressure (mmHg)	139.28 ± 4.10	115.28 ±3.93	<0.01
Diastolic Blood Pressure (mmHg)	94.12 ±3.14	76.28 ± 4.16	<0.01
Pulse Pressure (mmHg)	45.16 ± 5.54	39.00 ± 4.56	<0.01
Mean Arterial Pressure (mmHg)	109.17 ± 2.31	89.28 ± 3.48	<0.01

Pulse Pressure and Mean Arterial Pressure were calculated by following formula:
Pulse Pressure = Systolic Blood Pressure – Diastolic Blood Pressure.[9]

Mean Arterial Pressure = Diastolic Blood Pressure + 1/3 Pulse Pressure.[9]

Table 3: Haemoglobin, RBC Count, WBC Count, Platelet Count, Haematocrit, Mean Corpuscular Volume(MCV), Mean Corpuscular Haemoglobin(MCH), Mean Corpuscular Haemoglobin Concentration(MCHC) in study group and control group

Parameters	Study group	Control group	P value
Hemoglobin (gm/dl)	14.53 ± 1.28	13.78 ± 0.92	<0.01
RBC count(million/cumm)	5.67 ± 0.38	5.28 ± 0.51	<0.01
WBC count (cells/cumm)	7512 ± 1235.14	6296 ± 1221.23	<0.01
Platelet count (lacs/cumm)	2.05 ± 0.61	1.95 ± 0.32	>0.05
Hematocrit (%)	42.95 ± 3.32	41.26 ± 2.37	<0.01
MCV (µm3 or fl)	75.90 ± 4.74	78.77 ± 7.22	<0.05
MCH (pg)	25.67 ± 1.73	26.27 ± 2.21	>0.05
MCHC (%)	33.82 ± 0.92	33.41 ± 1.48	>0.05

DISCUSSION

Hypertension is a silent killer. It exerts a substantial public health burden on cardiovascular health status and health care system.[2] So, there is need to develop new investigating strategies to predict cardiovascular risk early and more accurately. This study was designed to assess and compare haematological parameters in hypertensives and normotensives.

Statistically, there was no significant difference in anthropometric parameters like height, weight, BMI

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and age. So, both groups of this study were found to be similar in these parameters. [Table 1]

In present study, pulse rate, systolic blood pressure, diastolic blood pressure, pulse pressure and mean arterial pressure were significantly higher in hypertensive group as compared to normotensive group. [Table 2]

Comparison of haemoglobin level in hypertensives and normotensives:

As shown in [Table 3], Hb value was significantly increased ($p<0.01$) in the hypertensive group (14.53+1.28) as compared to normotensive groups (13.78+0.92). This finding is in agreement with supported studies done by Giacomo et al,[10] Massimo et al,[11] Dan et al,[12] and Al-Muhana et al,[13] but it contradicts with a study conducted in São Paulo, Brazil.[14]

Comparison of RBC Count in hypertensives and normotensives:

As the [Table 3] shows, the mean value of RBC Count were found to be significantly higher ($p<0.01$) in the hypertensive group (5.67+0.38) than normotensive group (5.28+0.51). This finding is similar to the earlier findings by Giacomo et al,[10] Massimo et al,[11] Dan et al,[12] and Al-Muhana et al.[13]

Haematological complication such as decreased deformability of RBC causing haemolysis, leading to high free circulating Hb levels which may be associated with endothelial dysfunction.

Comparison of WBC Count in hypertensives and normotensives:

As the [Table 3] shows, the mean value of WBC Count were found to be significantly higher ($p<0.01$) in the hypertensive group (7512+1235.14) than normotensive group (6296+1221.23). The results are similar to the findings reported by Chong Do Lee et al,[15] Dong-Jun et al,[16] and Al-Muhana et al.[13] Chong Do Lee et al. found that elevated WBC Count is directly related with hypertension and also with the risk for cardiovascular disease incidence and mortality.

Comparison of Platelet Count in hypertensives and normotensives:

As the [Table 3] shows, In present study, The mean value of Platelet Count were found to be higher in the hypertensive group (2.05+0.61) than normotensive group(1.95+0.32) but not significant ($p>0.05$). These results are inconsistent with the studies reported by Giacomo et al,[10] Khandekar et al,[17] and Al-Muhana et al.[13]

Comparison of Haematocrit value in hypertensives and normotensives:

As the [Table 3] shows, the mean levels of Haematocrit were found to be significantly higher ($p<0.01$) in the hypertensive group (42.95+3.32) than normotensive group (41.26+2.37). This is similar to the findings of Giovanni de Simone et al,[18] Massimo et al,[11] Dan et al,[12] and Al-Muhana et al.[13]

Dan et al. studied the relation between blood viscosity and red cell measures in hypertensives and found that the haematocrit is a determinant of whole blood viscosity.

High haematocrit in hypertension could reflect a true increase in red blood cell mass as well as haemoconcentration caused by a reduction in plasma volume. Data from the study report cannot rule out the possibility that high haematocrit is characteristic of hypertensive people with reduced plasma volume.[11] In contrary to aforementioned result, contradicted study conducted at University of Port Harcourt teaching hospital, Nigeria.[19] and Saudi Arabia,[13] reported that haematocrit was not significantly differ between hypertensive patients and normotensive individuals. This dissimilarity may be due to difference in sample size.

Comparison of MCV, MCH and MCHC in hypertensives and normotensives:

As the [Table 3] shows, the mean value of Mean Corpuscular Volume (MCV) were found to be significantly lower ($p<0.05$) in the hypertensive group (75.90+4.74) than normotensive group (78.77+ 7.22). The MCV appears to be inversely related to blood pressure.

The above findings show that there is decreased Mean Corpuscular Volume (MCV) in primary hypertensives. These results are consistent with the studies reported by Dan et al,[12] Giacomo et al,[10] and Al-Muhana et al.[13] With the above results, the following hypothesis can be made to show how the increased blood pressure leads to decreased MCV: Viscosity affects peripheral resistance to blood flow, and peripheral resistance affects DBP. At high RBC value, MCV may be down regulated. This may lower whole blood viscosity and partially reduce DBP without compromising flow.[12]

In this study, MCH was decreased in hypertensives (25.67 +1.73) than normotensive group (26.27 + 2.21) but not significant ($p>0.05$).

MCHC was increased in hypertensives (33.82+0.92) than normotensive group (33.41+1.48) but not significant ($p>0.05$).

In this study, MCV was decreased significantly in hypertensive groups but there were no significant differences in MCH and MCHC. But other studies in these parameters showed different ideas. For example, a study conducted by Babu KR et al,[6] showed significantly lower MCV, significantly higher MCHC. In São Paulo, Brazil, MCV were similar,[14] in France MCV is lower by 2%,[20] and a study in Saudi Arabia showed no significant differences of MCV, MCH and MCHC.[13]

CONCLUSION

In present study, the mean value of Haemoglobin, RBC Count, WBC Count and PCV (Hct) were found to be significantly higher in primary hypertensive study group as compared to normotensive group while the mean value of MCV was detected to be significantly lower in

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hypertensive group as compared to normotensive group.

The mean value of Platelet count and MCHC was higher whereas MCH was lower in hypertensive group as compared to normotensive group but there was no statistically significant difference.

WBCs are inflammatory marker. Raised WBC Count is directly related with hypertension and also with the risk of coronary heart disease. Functional and structural alteration in platelets is seen in hypertension and could be the risk factor for various thrombotic disorders. Hematocrit is a determinant factor for high whole blood viscosity during hypertension. Therefore, it is important to evaluate changes in haematological parameters in hypertensive patients to detect the risk of silent vascular damage and could be used as prognostic markers.

So, Assessment of haematological parameters may be a used as predictor of coronary artery diseases. Identification of these high risk patients on the basis of deranged haematological parameters may indicate revise antihypertensive treatment modality.

In conclusion as per present study, it is advised to the hypertensive patients to get their haematological parameters checked regularly and should be assessed by the treating physician for any derangement and thus preventing future cardiovascular complications.

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