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EVALUATION OF HAEMATOLOGICAL PARAMETERS IN HYPERTENSIVE PATIENTS: LABORATORY BASED CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Hypertension is a major health problem worldwide. It can lead to cardiovascular disease and also leads to functional disturbances including hematological parameters. The abnormalities of haematological parameters may enhance an end-organ damage. **Objective:** the aim of this study was to assess some hematological parameters of hypertensive individuals in comparison with normotensive individuals at Rajshahi Medical College Hospital, Rajshahi, Bangladesh. **Materials and Method:** Based on selective purpose, the sample size for each group, hypertensive and non-hypertensive was 120 which resulted in sum amount of 240. **Results:** The respondents were given the privilege to speak freely so that they can express their normal and neutral opinion in response to the open questions. 55.7% of the respondents were in the age group of below 35 years who fell in hypertensive group whereas 58.3% of then were in the below 35 years age group who fell in normotensive group. Considering the gender ratio of the respondents, in normotensive group and in hypertensive group the male were respectively 61.2% and 75.06%. Among them, the majority of married people had the history of blood pressure compared to the unmarried people. The respondents who fell in hypertensive group, had lower MCV and higher level of MCH, HCT, RBC and hemoglobin. **Conclusion:** The study contains enough important information to be used as the

foundation of additional comprehensive study on the topic and to take applicable measures by the concerned.

KEYWORDS: Hypertension, Hematological parameters, Blood pressure indices, Bangladesh.

INTRODUCTION

High Blood Pressure is also known as Hypertension (HTN) which is a condition of elevating systemic arterial pressure above the threshold value.[1] Systolic (maximum) and Diastolic (minimum) arterial pressures are the two stages of expressing HTN. During the shrinkage of the left ventricle of the heart, the systolic pressure occurs whereas the diastolic pressure is observed prior to the next contraction. Routinely, the standard measure of systolic pressure is within 100–140 mmHg (mm mercury) and diastolic pressure is within 60–90 mmHg.[2,3] Wayback in 2008, the report of the seventh Joint National Committee (7 JNC) defined systolic blood pressure (SBP) < 120 mmHg as normal and the normal range for diastolic blood pressure (DBP) is < 80 mmHg. The report also defined the normal ranges for pre-HTN to be SBP of 120-139 mmHg or DBP 80–89 mmHg. Following that SBP at stage I HTN is 140–159 mmHg or DBP 90–99 mmHg and stage II HTN with SBP ≥ 160 mmHg or DBP ≥ 100 mmHg.[1,4] Primary and Secondary Hypertensions are the two categories of HTN. 95% of the cases are observed to be Primary which can befall without any apparent core causes. On the contrary, secondary HTN is developed because of being inferior to diseases such as endocrine syndromes, kidney disease and tapering of the aorta or kidney arteries.[5,6] About 20 to 30 percent of the world's adult population is affected by the HTN and so it is considered as a major health problem worldwide.[7] Despite the focus of developing the guidelines were made on medical practice in the United States,[8] the change in prevalence of hypertension may be led on a global scale for the universal implementation of the new guidelines.[9] In global perspective, the treatment and prevention of the development of CVDs may be influenced through being implicated by full or partial adoption of the 2017 ACC/AHA guidelines. Currently, using the 2017 ACC/AHA, Bangladesh is considered as a nation with high CVD-related morbidity and mortality where hypertension prevails at large.[10,11] Usually, the hematological parameters of hypertensive patients are borne contradictory results in different countries. Furthermore, information related to hematological parameters in hypertensive patients in Rajshahi, Bangladesh has deficiencies. Consequently, this study was intended to evaluate hematological parameters in hypertensive patients compared to

ostensible healthy individuals and associating hematological parameters with blood pressure indices (Systolic blood pressure and diastolic blood pressure) at University of Rajshahi, Bangladesh.

MATERIALS AND METHODS

This was a cross sectional type of comparative study which was conducted in Department of Biochemistry & Haematology, Rajshahi Medical College Hospital, Rajshahi. All the hypertensive patients attending Rajshahi Medical College Hospital, Rajshahi, Islami Bank medical College Hospital, Rajshahi and Barind Medical College Hospital, Rajshahi during the study period were considered as study population. All the hypertensive patients attending Rajshahi Medical College Hospital, Rajshahi, Islami Bank medical College Hospital, Rajshahi and Barind Medical College Hospital, Rajshahi during the study period included in the study. Patients with hypertension and others systemic diseases were excluded. So, total sample size was taken 120 in each group after calculating the sample size. Purposive sampling technique was used. The researcher himself collected data from the hypertensive patients attending Rajshahi Medical College Hospital, Rajshahi, Islami Bank Medical College Hospital, Rajshahi and Barind Medical College Hospital, Rajshahi by face to face interview through a partially structured questionnaire. Baseline information on some selected socio-demographic and biological characteristics of the respondents and information regarding hypertension was collected. All efforts were made to collect data accurately. For open questions, the respondents were asked in such a manner so that they could speak freely and explain their opinion in a normal and neutral way. No leading questions were asked. About 5-6 ml of venous blood will be collected from all the study participants by venipuncture under aseptic precaution. Then the hematological parameters of hypertensive and normotensive are collected by using auto analyzer machine. Statistical analyses of the results were obtained by using window-based computer software devised with Statistical Packages for Social Sciences (SPSS-23). Prior to the commencement of the study, the research protocol was approved by the ethical committee of the Institute of Biological Sciences of University of Rajshahi. The permission of the authority of Rajshahi Medical College Hospital, Rajshahi, Islami Bank Medical College Hospital, Rajshahi and Barind medical College Hospital, Rajshahi was taken before starting the study.

Ethical issue

The study was approved by the Institutional Animal, Medical ethics, Bio-safety and Bio-security Committees (IAMEBBC), Institute of Biological Sciences (IBSc), University of Rajshahi, Bangladesh.

Statistical analysis

The data were entered and analyzed by using Statistical Package for Social Science (SPSS) version 25 software. Results were computed separately for each of the two hypertensive and non-hypertensive group in the study. The results were expressed in percentage.

Selection criteria of the patients

1. Inclusion criteria: All the hypertensive patients attending Rajshahi Medical College Hospital, Rajshahi, Islami Bank medical College Hospital, Rajshahi and Barind Medical College Hospital, Rajshahi during the study period included in the study.
2. Exclusion criteria: Unwilling to participate, patients with hypertension and others systemic diseases, did not give consent to participate in an interview.

RESULTS

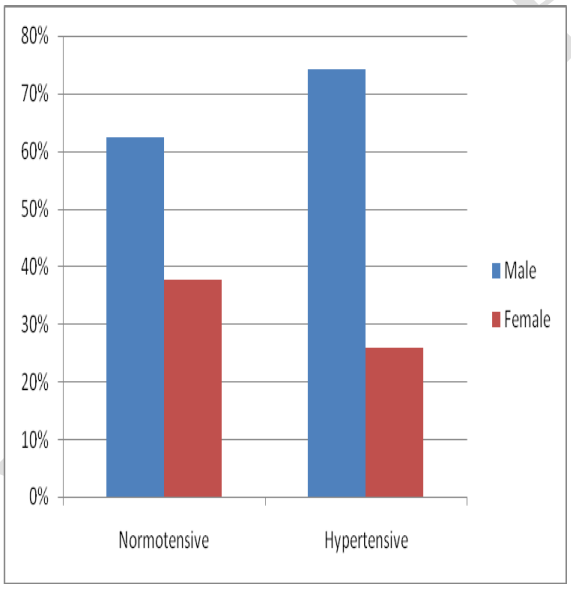
Regarding age group of the respondents it was revealed that 55.7% were in the age group of <35 years, 37.7% were in the 35-45 years age group and 6.5% were more than 45 years age group in hypertensive group. About 58.3% in the <35 years age group, 26.7% were 35-45 years age group and 15.0% were in the age group of >45 years. It was revealed that among the hypertensive group 56.7% had <15000 BDT as monthly family income, 25.6% had >30000 BDT and 19.7% had 15000-30000 BDT as monthly family income. In non-hypertensive group most (58.3%) of the respondents had <15000 BDT as monthly family income, 28.3% had 15000-30000 BDT and 13.3% had >30000 BDT as monthly family income. It was found that 98.3% of the respondents had >130 mm of Hg as systolic blood pressure and 1.6% had 120-129 mm of Hg as systolic blood pressure among the hypertensive group. In non-hypertensive group 83.3% had <120 mm of Hg as systolic pressure and 16.7% had 120-129 mm of Hg. Regarding diastolic blood pressure it was found that 97.2% of the respondents had >90 mm of Hg and 2.8% had 80-89 mm of Hg of diastolic blood pressure. In non-hypertensive group 87.3% had <80mm of Hg as diastolic blood pressure and 13.3% had 80-89 mm of Hg of diastolic blood pressure. In hypertensive group majority (93.3%) of the respondents had >18 gm/dl Hb level, 5.0% had 12-18 gm/dl and 1.7% had <12 gm/dl. In non-hypertensive group it was found that 88.3% had 12-18 gm/dl of Hb, 6.7% had >18 gm/dl and

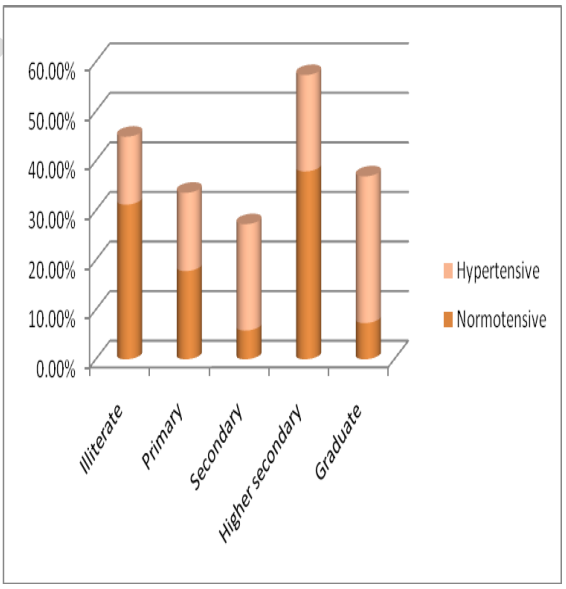
5.0% had <12 gm/dl of Hb. Regarding MCV in hypertensive groups it was found that 91.7% were in the group of <80.0 fL, 5.0% were 80-100 fL and 3.3% had >100 fL. Among the non-hypertensive group 90.0% were in the group of 80-100 fL, 10.0% were >100 fL. About 90.7% of the hypertensive group had >33.2 Pg of MCH, 8.3% had <27.5 Pg and 1.0% had 27.5-33.2 Pg. in non-hypertensive group 61.7% had 27.5-33.2 Pg, 36.7% had <27.5 Pg and 1.7% had >33.2 Pg of MCH. Regarding MCHC it was found that among the hypertensive group 88.3% had 31.5-35.0 g/dl, 8.3% had >35 and 3.3% had <31.5. Among the non-hypertensive group 75.0% were in the group of 31.5-35.0 g/dl, 20.0% had <31.5 and 5.0% had >35.0 g/dl. Regarding hematocrit it was found that 85.0% had >50% and 14.4% had 41-50.0% in hypertensive group. Among the non-hypertensive group 97.3% had 41-50.0% of hematocrit and 2.7% had >50% of hematocrit (Table-1).

Table no. 01: Distribution of the respondents with different socio-demographic variables.

Different socio-demographic variables:		**Hypertensive (N=120)**	**Non-Hypertensive (N=120)**
Age group of the respondents in years	<35	68 (55.7%)	70 (58.3%)
	35-45	46 (37.7%)	32 (26.7%)
	45+	6 (6.5%)	18 (15.0%)
	Total	120 (100.0%)	120 (100.0%)
(mean ± SD)		38.25 ± 6.14 years	41.26 ± 8.19 years
Monthly family income in taka	<15000	68 (56.7%)	70 (58.3%)
	15000-30000	20 (19.7%)	34(28.3%)
	>30000	32 (25.6%)	16 (13.3%)
	Total	120 (100.0%)	120 (100.0%)
(mean ± SD)		28413.42 ± 11090.18	21826.66 ± 10094.18
Systolic blood pressure group			
<120 mm of Hg		0 (0.0%)	92 (83.3%)
120-129 mm of Hg		2 (1.6%)	28 (16.7%)
>130 mm of Hg[12]		118 (98.3%)	0 (0.0%)
Total		120 (100.0%)	120 (100.0%)
(mean ± SD)		149.17 ± 11.26 mm of Hg	110.23 ± 8.79 mm of Hg
Diastolic blood pressure group			
<80 mm of Hg		0 (0.0%)	101 (87.3%)
80-89 mm of Hg		5 (2.8%)	19 (13.3%)
>90 mm of Hg[12]		115 (97.2%)	0 (0.0%)
Total		120 (100.0%)	120 (100.0%)
(mean ± SD)		98.90 ± 5.80 mm of Hg	78.5 ± 3.32 mm of Hg
Hb%	<12 gm/dl	2 (1.7%)	6 (5.0%)
	12-18 gm/dl	6 (5.0%)	106 (88.3%)
	>18 gm/dl[13]	112 (93.3%)	8 (6.7%)
Total		120 (100.0%)	120 (100.0%)

(mean ± SD)	19.15 ± 1.12	15.34 ± 1.20
MCV		
<80.0 fL	110 (91.7%)	0 (0.0%)
80-100 fL	6 (5.0%)	108 (90.0%)
>100 fL[14]	4 (3.3%)	12 (10.0%)
Total	120 (100.0%)	60 (100.0%)
(mean ± SD)	69.59 ± 8.4 fL	92.16 ± 2.97 fL
MCH		
< 27.5 Pg	10 (8.3%)	44 (36.7%)
27.5-33.2 Pg	2 (1.0%)	74 (61.7%)
>33.2 Pg[15]	108 (90.7%)	2 (1.7%)
Total	120 (100.0%)	120 (100.0%)
(mean ± SD)	38.9 ± 9.53 Pg	27.14 ± 1.12 Pg
MCHC		
< 31.5 g/dl	4 (3.3%)	24 (20.0%)
31.5-35.0 g/dl	106 (88.3%)	90 (75.0%)
>35 g/dl[16]	10 (8.3%)	6 (5.0%)
Total	120 (100.0%)	120 (100.0%)
(mean ± SD)	35.14 ± 1.25 g/dl	31.11 ± 1.50 g/dl
Hematocrit		
41-50.0 %	14 (14.4%)	118 (97.3%)
>50 %	106 (85.6%)	2 (2.7%)
Total	120 (100.0%)	120 (100.0%)
(mean ± SD)	58.83 ± 3.03 %	44.20 ± 2.61 %





It was discovered that around 38% of the respondents were female in normotensive group and 28% in hypertensive group. About 61.2% were male in normotensive group and 75.06% were male in hypertensive group. It was showing that among the normotensive group more respondents were illiterate and had less education in comparison to hypertensive group (Figure-1, 2).

DISCUSSION

This cross sectional type of comparative study was carried out to find out the different hematological parameters among the hypertensive and normotensive individuals. The sample size was 120 in each group (Hypertensive and normotensive) which was selected purposively. Regarding age group of the respondents it was revealed that 55.7% were in the age group of <35 years, 37.7% were in the 35-45 years age group and 6.5% were more than 45 years age group in hypertensive group. About 58.3% in the <35 years age group, 26.7% were 35-45 years age group and 15.0% were in the age group of >45 years. 50.3 ± 11 and 49.8 ± 11.6 years were respectively the mean age of hypertensive and control individuals.[17] It was discovered that around 38% of the respondents were female in normotensive group and 28% in hypertensive group. About 61.2% were male in normotensive group and 75.06% were male in hypertensive group. It was revealed that among the hypertensive group 56.7% had <15000 BDT as monthly family income, 25.6% had >30000 BDT and 19.7% had 15000-30000 BDT as monthly family income. In non-hypertensive group most (58.3%) of the respondents had <15000 BDT as monthly family income, 28.3% had 15000-30000 BDT and 13.3% had >30000 BDT as monthly family income. It was showing that among the normotensive group more respondents were illiterate and had less education in comparison to hypertensive group. It was found that 98.3% of the respondents had >130 mm of Hg as systolic blood pressure and 1.6% had 120-129 mm of Hg as systolic blood pressure among the hypertensive group. In non-hypertensive group 83.3% had <120 mm of Hg as systolic pressure and 16.7% had 120-129 mm of Hg. 121.33 ± 9.99 mm of Hg was the mean systolic blood pressure of the respondents. Vascular endothelial dysfunction is observed during HTN.[18] Regarding diastolic blood pressure it was found that 97.2% of the respondents had >90 mm of Hg and 2.8% had 80-89 mm of Hg of diastolic blood pressure. In non-hypertensive group 87.3% had <80mm of Hg as diastolic blood pressure and 13.3% had 80-89 mm of Hg of diastolic blood pressure. In hypertensive group majority (93.3%) of the respondents had >18 gm/dl Hb level, 5.0% had 12-18 gm/dl and 1.7% had <12 gm/dl. In non-hypertensive group it was found that 88.3% had 12-18 gm/dl of Hb, 6.7% had >18 gm/dl and 5.0% had <12 gm/dl of Hb. Hb and HTN is closely associated and in a recent cross-sectional study on Korean population, it was also investigated that the association also positively exists Hb level with SBP and DBP [19] The connotation amid HTN and Hgb level may be elucidated by Hgb and arginase enzyme effects on nitric oxide (NO) bioavailability.[17] Regarding MCV in hypertensive groups it was found that 91.7% were in the group of <80.0 fL, 5.0% were 80-100 fL and 3.3% had >100 fL. Among the non-

hypertensive group 90.0% were in the group of 80-100 fL, 10.0% were >100 fL. Mean corpuscular volume (MCV) is shown as a hypertension-related risk factor in some studies,[7,20] whereas no relationship is shown by other amongst MCV and hypertension .[21] A case–control study was conducted among 100 hypertensive patients and 100 normotensive subjects which confirmed that MCV seems to be contrariwise related to systolic and diastolic blood pressure.[7] Consistent with these findings, we showed that compared to the control group MCV is decreased in HTN individuals. About 90.7% of the hypertensive group had >33.2 Pg of MCH, 8.3% had <27.5 Pg and 1.0% had 27.5-33.2 Pg. in non-hypertensive group 61.7% had 27.5-33.2 Pg, 36.7% had <27.5 Pg and 1.7% had >33.2 Pg of MCH. Regarding MCHC it was found that among the hypertensive group 88.3% had 31.5-35.0 g/dl, 8.3% had >35 and 3.3% had <31.5. Among the non-hypertensive group 75.0% were in the group of 31.5-35.0 g/dl, 20.0% had <31.5 and 5.0% had >35.0 g/dl. In our study, there was no significant difference in mean corpuscular hemoglobin concentration (MCHC) between HTN and NTN groups. These results are in contrast to those studies reported an increased or decreased level of MCHC in HTN subjects.[7] Regarding hematocrit it was found that 85.0% had >50% and 14.4% had 41-50.0% in hypertensive group. Among the non-hypertensive group 97.3% had 41-50.0% of hematocrit and 2.7% had >50% of hematocrit. As reported by Jae *et al.* and according to the findings, there is a connection between HCT and occurrence of hypertension during 5 years of a period of mean follow up. Still, their conducted the study by restricting the population to men.[22] In an enormous cross- sectional study, Liu et al. found a self-governing relation between HCT and pre-hypertension in Chinese population.[23]

CONCLUSION

Compared to apparently healthy controls, in the hypertensive group, the present study shows the median (IQR) value of Hgb, HCT, MCV and the mean value of MCHC were pointedly higher. Hypertensive end-organ damage may strongly be indicated by impaired hematological parameters. RBCs reduction in deformability and an increase in the size cause hemolysis, high Hgb are the hematological complications trending to cardiovascular risk. However, the activation of platelets is a major risk factor for thrombotic diseases which is observed during hypertension. Hence, the assessment of changes is important and required in hematological parameters for hypertensive patients since it helps to avoid such complications associated with hematological syndromes.

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